ENGINEERING LITERATURE

M. N. Baker, Editor

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The lists of books for the library of a young civil engineer, sent in a response to a request in the last issue of the Supplement, and printed elsewhere in this number, cannot fail to interest many engineers, and it is hoped that other lists will be submitted; or suggestions and criticisms regarding the lists now published. In a later issue perhaps some editorial comments on the subject of working libraries will be offered.

Those who have occasion to buy foreign books may be aware that there is a duty on such as are printed in English, but that those in French, German or Spanish are admitted without charge. We do not propose to enter into a discussion of the merits of this discrimination, or of the merits or demerits of a tariff on books in any language. It does seem fitting to state, for the benefit of any who may be interested, that there is a movement on foot to secure the removal of the existing duty, and that further information, in the form of a neat little pamphlet, may be obtained by addressing Mr. Geo. P. Brett, President of The Macmillan Co., 66 Fifth Ave., New York city.

The British publication known as "Science Abstracts" is to be issued hereafter in two parts. Section A will be devoted to Physics and the physical arts and sciences, and Section B to Mechanical and Electric Engineering. The American Physical Society now takes part in directing the publication, and has elected Prof. E. H. Hall, of Harvard University, as its representative. The American Institute of Electrical Engineers is also coöperating in the work, and its members can learn of reduced rates offered to them by applying to its secretary. The members of the American Physical Society receive Section A without charge. The "Abstracts" were formerly issued by the Physical Society of London, and the Institution of Electrical Engineers, and Mr. P W. de Tunzelmann, 82 Victoria St., London, S. W., continues as editor.

As exemplifying the fact that the value of scientific literature often varies inversely as the square of its mass, we may with profit consider Bulletins No. 198 and No. 199 of the U. S. Geological Survey. Bulletin No. 198, by W. T. Griswold, contains in 42 pages (with map) a most admirable discussion of the oil deposits of eastern Ohio. Bulletin No. 199, by Israel C. Russell, treats of the geology and water resources of the Snake River Plains of Idaho, and the author takes 185 pages in which to describe the scenery of the region, primarily, and the geology incidentally.

After a brief but clear account of the theory of petroleum genesis and its mode of collection in pools underlying a cap of impervious rock, Mr. Griswold takes up the detailed description of the Cadiz quadrangle which includes parts of Jefferson, Harrison, and Carrol counties, Ohio. The mode of constructing the contour map of the "oil sands" is described, the contour interval being 10 ft. About 200 bench-marks have been established in this quadrangle, and their position is noted on the map, beside which a table is given descriptive of each bench-mark. From these bench-marks levels were run to about 500 outcrops of recognized geological horizon, and from the elevations so obtained the elevation of the Berea Grit oil sand was calculated and plotted, contours being interpolated.

The author says among other generalizations:

> No long and steep slope [of the grit] exists in the quadrangle. . . . This lack of decided slope for a considerable distance is unfavorable to the probable accumulation of a large pool of oil, since no large area of oil-producing territory has been drained into a single continuous reservoir.

The author then proceeds to point out the favorable spots on the map where oil prospecting may be conducted with greatest probability of success. He closes by indicating how the probable depth of a well in any given locality may be determined from the structural map, aided by a short line of leveling from the nearest B. M.

As typifying what the U. S. Geological Survey ought oftener to produce this little monograph by Mr. Griswold is admirable. It is short, to the point, full of data, and in every way praiseworthy because of its practical value.

Turning to its antithesis, Bulletin No. 199, by Mr. Russell, we have a long, obscure, dataless dissertation on the Snake River country.

For two pages or more the author exercises his talent as a word artist in picturing:

> The distant mountains, rising range above range, and culminating in some far-off sun-kissed peak . . . while all below is dark and shadowy.

"Dark and shadowy" expresses one's opinion of most of the text in the ponderous effusion that appears in some eight score of pages which follow:

It may be that because we too have slept on these same Snake River "Plains," and because we are not poetical that we become impatient as we read:

> As evening approaches there is a gradual change from glare to shadow. The broad plains become a sea of purple on which float the still shimmering mountains. . . . As the sun sinks lower there are, perhaps, a few clouds near at hand which are seemingly burned or rendered molten by the intense heat, but more frequently only a nebulous glory appears in the vaporless air.

And still more frequently, we feel like adding, the air becomes saturated with vapor from the camp-fire coffee pot which has boiled over during our flights of oratorical speculations, and nearer at hand even than the "burned clouds," is the burnt "sow belly."

We are safe in saying that the photographs are by all odds the most valuable, if not always the most interesting part of this monograph, in which the author takes the first half in telling us what he is going to say, and the last half in saying what he has told us.

Of 39 pages devoted to "Water Resources" no less than ten are given up to definitions and descriptions of springs and wells in general, before the author proceeds with his notes on specific streams, springs, and wells.

Books on Landscape Architecture or Gardening.

Engineers have many opportunities to do or to induce others to do good work in landscape architecture. How often do they improve such chances? As a rule, it is not to be supposed that an engineer will become proficient in the architecture of landscapes, any more than in that of buildings, but it is incumbent on engineers in many lines of practice to have at least a general knowledge of the importance and possibilities of landscape architecture, and to use all reasonable means to further the practice of that art. A long article might be written in support of the latter statement, but as we have good evidence that some engineers already accept it, and believe that many more are ready to do so, we shall at once proceed to answer the following inquiry from a correspondent:

> Sir: Can you give me the names of some good books that you can recommend on Landscape Architecture? Something practical and at the same time instructive in principles. Very truly yours,
>
> H. E. Eckles.
>
> Zion City, Ill., Jan. 19, 1903.

There is no comprehensive American book (in print) on landscape architecture or gardening, but there is an American reprint of a detailed and suggestive English treatise, and there are a number of good American books that partly cover the subject. The English work is Kemp's "How to Lay Out a Garden," but garden as here meant includes areas "from a quarter of an acre to a hundred acres in extent." The American reprint ($2.50) is from the second London edition, the preface to which is dated March 31, 1858. This book lays down at length the general principles of landscape design, under such heads as simplicity, intricacy, convenience, unity and congruity, symmetry, richness and polish, contrast, fitness and beauty. Shelters or windbreaks, walks and drives, fences, outlines of plantations and of beds, flower borders, specimen plants, evergreens, mounds and banks, shadows from trees, covered ways, and hedges are some of the many "objects" discussed in detail. A long chapter on "Special Departments" takes up at length the park, field and paddock; the flower, rock or fern, rose and winter garden; the bowling green, water, arbor, statuary, greenhouse, kitchen garden, aviary, lodge; and the seaside, lawn, and village garden. Finally, under "Practical Directions," engineering, planting, seeding and like topics are treated. The book contains many illustrations, both detail sketches to illustrate principles, and plans of gardens and estates. Most of the latter show work done by the author, who appears to have had a large and successful practice. Mention should be made of the fact that the author discusses formal gardening, and also the relation of architecture to landscape gardening.

Parson's "Landscape Gardening," first published in 1891 (New York, $3.50) was written, the author states in his introduction, "to arouse, by simple desultory talks, increased enthusiasm for lawn-making among men of moderate means." The scope of the book, however, is broader than this quotation indicates, as will be seen from the following outline of its contents: After an introduction and a general discussion of lawns and lawn-making the author devotes a chapter to "The Treatment of Sloping Grounds," which perhaps comes nearer than any other portion of the volume to discussing some of the fundamental principles of landscape design. Or perhaps it would be more correct to say that the author here discusses that part of landscape architecture that relates to the shape and shaping of the land, rather than to landscape effects obtained by planting. The author next takes up the means to be pursued in obtaining seasonal effects on the lawn, considering first spring, then June, and summer; then green and colored autumnal foliage; and, finally, planting for winter

effect. These six chapters relate almost wholly to the selection of trees, shrubs, and flowers, but principally the two former, and as they, like the other chapters, are profusely and handsomely illustrated with engravings on a liberal scale, and as the author writes as a master of his subject, these chapters are very valuable. As a whole, their value lies largely in the fact that they afford instructions for all-the-year effects, instead of concentrating attention upon a brief and evanescent scene of floral beauty. Most people want, or rather they would want if only they realized half the possibilities open to them, assistance in obtaining pleasing landscape effects in the fall, winter and early spring even more than during the rest of the year. These chapters show how a panorama of beauty, all the more delightful because so filled with contrasts, may be secured through twelve months of the year.

After considering seasonal effects there are several chapters on garden flowers and bedding plants, one on ponds and lakes, and a special chapter on "Lawn-Planting" for small places. City parks have a chapter of some twenty-five pages. Railways, churchyards, and cemeteries are briefly considered, and there are a few pages on rookeries.

A companion volume to the foregoing, but more in general make up than in plan and mode of treatment, is Roses' "Lawns and Gardens" (New York, 1897; $3.50). It has an opening chapter of fair length and merit on the "Study of Natural Scenery," after which implements, plans, gradings, and drives and walks are taken up in succession. Then follow three chapters on selecting and placing trees, shrubs and plants, and a number of other chapters on the lawn, rocks and water, flower beds, hedges, buildings and their embellishment, and the orchard and kitchen garden. The larger part of the volume is taken up with classified descriptions of deciduous, coniferous and flowering trees, ornamental shrubs, creepers and vines, and herbaceous plants. The book is profusely illustrated, with pen drawings, which add greatly to both its charm and value.

Two less pretentious books of American origin are Parson's "How to Plant the Home Grounds" (New York, 1899; $1 net) and Maynard's "Landscape Gardening as Applied to Home Decoration" (New York, 1899; $1.50). The first of these, naturally enough, resembles in some respects the larger work of the author, already noticed, but in general it goes more into the details of planning and planting than does the larger book, and gives less space to individual trees, shrubs and flowers. On this account the smaller book is perhaps the better for the amateur, if only one could be afforded, but the discussion of seasonal effects in the larger book is alone well worth its price. Maynard's work has some decided advantages of its own. It goes rather more than does Parson's into some of the details of laying out and preparing grounds, and has a chapter on injurious insects and on fruit gardens. Each of these books is good, but of the two probably most people, especially if of a practical turn, like engineers, would get most good from Parson's. Another excellent little book, mostly on gardening pure and simple, but with quite a bit of most sensible advice on landscape effect, is Bailey's "Garden-Making" (New York, 1899; $1). A book of quite another type which may be mentioned in passing is Blomfield and Thomas' "The Formal Garden in England" (London and New York, 1892; $3.). This or some other work on strictly formal gardening should not be overlooked by anyone who wishes to master the subject of landscape gardening.

A book which every one who has to do with municipal engineering might own with profit is Robinson's "Improvement of Towns and Cities" (New York, 1901; $1.25). It discusses various phases of municipal esthetics in an able and interesting manner. There are also some good suggestions in a book published in England entitled "Art and Life and the Building and Decoration of Cities."

Of course no one who seriously takes up landscape gardening or architecture, whichever he may choose to call it, will neglect the many books devoted to the achievements of the European masters of the art. As an introduction to these, and as an epitome of some of the best foreign work, we can heartily commend "European and Japanese Gardens" (Philadelphia, 1902; $2, or $2.15 by mail.) This comprises a series of papers on Italian, English, French and Japanese gardens, by different authors, read before the American Institute of Architects in 1900. The book is freely and handsomely illustrated. On pp. 221-2 of "Charles Eliot, Landscape Architect," reviewed elsewhere in this issue, will be found "A list of Books on Landscape Gardening," beginning with Bacon's charming essay "Of Gardens," first published in 1625, and going on down to Loudon's "Encyclopedia of Gardening" (London, 1822), and Gilpin's "Practical Hints on Landscape Gardening" (1832). Bacon's essay was separately printed a short time ago (New York, 1902; 75 cts. net). In Sieveking's "Gardens, Ancient and Modern" (London, 1899; $3), there is an "Historical Epilogue" of nearly a hundred pages, with bibliographical lists of books in various languages on gardens and landscape gardening. The main part of Sieveking's book is made up of numerous extracts from various writers which first appeared under the title "In Praise of Gardens." The extracts range from the most ancient to very recent times.

It will be understood that there have been published of late, a multitude of books on gardens and gardening, all of which bear directly or indirectly on landscape work. The popular interest in gardening and other out-of-door interests has grown so much recently that such books are coming to be in great demand, and many of them can be examined in any good book shop.

Within the past two years two monthly magazines have been started in this country, which have already won for themselves an important place in the periodical literature of the day, and which seem certain to have a most beneficial effect upon landscape architecture. Reference is made to "Country Life in America," and to "House and Garden," published at New York and Philadelphia, respectively. The first of these is too well known to need description. The other is particularly valuable because it joins together, as they should be, a consideration of the architecture of buildings and of grounds and plantations. The annual reports of the American Park and Outdoor Art Association also deserve mention.

Before concluding this article reference should be made to the writings of two Americans, each cut off at an early age, who did much for landscape architecture in this country, A. J. Downing and Charles Eliot. The former, in 1849, published "A Treatise on the Theory and Practice of Landscape Gardening," which seems to have been the first, and until quite recently the only, American treatise on the subject. The writings of the latter which, with the works executed under his direction, have had a great influence of late, have just been collected by President Eliot, of Harvard University, and are noticed elsewhere in this issue. Rightly studied, these essays and reports, combined with the sketch of young Eliot's studies at home and abroad, and of his professional career, cannot but prove of the greatest assistance to anyone engaged in landscape architecture. Unfortunately Downing's "Landscape Architecture," and also the "Rural Essays" published after his death, are both out of print, though diligent search in the book shops of the larger cities would doubtless be rewarded by finding a copy of one or the other of these charming old green-covered volumes. The "Landscape Architecture" ranks high with other books of its class, and is well worth the trouble that may be required to secure it.

CORRESPONDENCE.

A Small Library for a Young Civil Engineer.

Sir: In reply to your inquiry for the best 25 books for the library of a "Young Engineer," I would suggest the following:

1. Churches' Mechanics of Engineering—Solids and Fluids.
2 to 5. Merriman and Jacoby's Roofs and Bridges: Part I.—Stresses; II.—Graphic Statics; III.—Bridge Design; IV.—Higher Structures.
6. Johnson's Modern Framed Structures.
7. Carnegie's Pocket Companion.
8. Smoley's Tables of Squares.
9. Reinhardt's Lettering.
10. Reinhardt's Technic of Mechanical Drafting.
11. Trautwine's Civil Engineer's Pocket Book.
12. Johnson's Theory and Practice of Surveying.
13. Searles' Field Engineering.
14. Crandall's Earthwork Tables.
15. Crandall's The Transition Curve.
16. Wellington's Location of Railways.
17. Tratman's Railway Track and Track Work.
18. Johnson's Materials of Construction.
19. Johnson's Engineering Contracts and Specifications.
20. Baker's Masonry Construction.
21. Vegas' Logarithms.
22. Coffin's Graphical Solution of Hydraulic Problems.
23. Wilson's Manual of Irrigation Engineering.
24. Baker's Treatise on Roads and Pavements.
25. Molitor and Beard's Manual for Resident Engineers.

Very truly yours, C. W. J. Neville.

6032 Kimbark Ave., Chicago, Ill., Feb. 23, 1903.

Sir: Referring to the enquiry of "R. N. B.," asking for a list for a working library, I would suggest the last ten or fifteen years of Engineering News, if they can be procured. These should be supplemented by Engineering Index, Vols. 1, 2 and 3. I would also advise as many volumes of the "Transactions of the American Society of Civil Engineers" as are obtainable.

Some few other works should be added, such as: Baker's Masonry Construction; Johnson's Materials of Construction; Rice's Tables of Excavation and Embankment.

Yours truly, G. B. Nicholson,
Chief Engineer, C., N. O. & Tex. Pac. Ry. Co.

Cincinnati, O., March 4, 1903.

Sir: Every engineers' library reflects more or less his leanings toward a specialty. But an attempt at a general list can be made selecting from the writer's own library.

1. Trautwine's Civil Engineer's Pocket Book.
2. Kent's Mechanical Engineer's Pocket Book.
3. Foster's Electrical Engineer's Pocket Book.
4. Kidder's Architect's and Builder's Pocket Book.
5. Haswell's Mechanic's and Engineer's Pocket Book.
6. Wellington's Economic Theory of Railway Location.
7. Baker's Masonry Construction.
8. Patton's Foundations.
9. Johnson's Materials of Construction.
10. Johnson's Engineering Contracts and Specifications.
11. Johnson's Surveying.
12. Wait's Engineering Jurisprudence.
13. Wait's Law of Operations.
14. Byrnes' Highway Construction.
15. Baumeister's Cleaning and Sewerage of Cities.
16. Gould's Elements of Water Supply Engineering.
17. Merriman and Jacoby's Roofs and Bridges; 4 vols.
18. Merriman's Hydraulics.
19. Bell's Electrical Transmission.
20. Kidder on Building Construction.

By subscribing to some good periodicals and keeping track of the book reviews an engineer having the above books as a start can know what books to add from time to time as he feels able to afford it. It is a good idea when a job is secured to add the best books dealing with that subject. In this way the writer has accumulated a good library dealing especially with irrigation, land drainage and municipal work.

Periodicals form the most valuable part of an engineer's library. Engineering News, "Engineering Record," "The Engineering Magazine," and "The Journal of the Association of Engineering Societies," are the best. They should be regularly bound and indexed.

All fragmentary engineering literature should be kept. It should be filed in cases, and card indexed. This includes transactions of societies, circulars, price-lists, catalogues and monographs. If an engineer is located his library is bound to grow if he tries to keep up with the times. If he moves around much then he can cut his library down to the pocket books and one periodical.

Yours truly, Ernest McCullough.

Lewiston, Idaho, March 4, 1903.

Sir: I send a list of what I consider to be 40 good books for the "young engineer." It is assumed that the young man will have had sufficient training not to require elementary treatises, and that he will follow a general practice tending rather more to municipal work. I have under No. 40 introduced a general title of "Reports" in order to emphasize the importance of this source of information, usually of the greatest value, most economically obtained, and one of which the young engineer should certainly avail himself. Yours very truly, Theodore Horton,
Principal Assistant, Hering & Fuller.

170 Broadway, New York, March 10, 1903.

1. Descriptive Indices of Current Engineering Literature.
2. Baker's Municipal Year Book.
3. Trautwine's Civil Engineer's Pocket Book.
4. Kent's Mechanical Engineer's Pocket Book.
5. Allen's Railroad Curves and Earthwork.
6. Moore's Earthwork Tables.
7. Johnson's Theory and Practice of Surveying.
8. Baker's Treatise on Masonry Construction.

9. Byrne's Inspection of Material and Workmanship.
10. Patton's Treatise on Foundations.
11. Spalding's Hydraulic Cement.
12. Johnson's Engineering Contracts and Specifications.
13. Lanza's Applied Mechanics and Strength of Materials.
14. Merriman and Jacoby's Text Book of Roofs and Bridges.
15. Waddell's De Pontibus.
16. Johnson's The Materials of Construction.
17. Turneaure & Russell's Public Water Supplies.
18. Merriman's Treatise on Hydraulics.
19. Hering and Trautwine's Flow in Open Channels.
20. Frizell's Water Power.
21. Weston's Tables Showing Loss of Head due to Friction of Water in Pipes.
22. Swan and Horton's Hydraulic Diagrams.
23. Weston's Tables on the Cost of Laying Water Pipe.
24. Folwell's Sewerage.
25. Baumeister's Cleaning and Sewerage of Cities.
26. Sedgwick's Sanitary Science and the Public Health.
27. Hazan's Filtration of Public Water Supplies.
28. Fuller's Water Purification at Louisville (Mechanical Filtration).
29. Rafter and Baker's Sewage Disposal in the United States.
30. Tilson's Street Pavements and Paving Materials.
31. Herschel and North's Road Construction and Maintenance.
32. Thurston's Manual of Steam Engineering.
33. Peabody and Miller's Steam Boilers.
34. Barr's Pumping Machinery.
35. "Engineering Record's" Water Tower and Pumping Station Design.
36. Gerhard's Sanitary Engineering of Buildings.
37. Billing's Steam Heating and Ventilation.
38. Foster's Electrical Engineer's Pocket Book.
39. Newell's Irrigation in the United States.
40. Special, private and public reports on various subjects.

Concerning the Definition of Entropy.

Sir: Your review of my "Thermodynamics" in your issue of Feb. 19 questions the validity of my attempt at defining entropy as a physical reality, of use to the engineer as a natural conception. Allow me to reply.

Your reviewer's position, condensed, is that my attempt is hopeless, (1) because entropy "cannot be measured in feet or weighed in pounds," and (2) because "it is a mathematical function and nothing else."

Every engineer who deals with moving forces, whether in steam-engines, pile-drivers, water-power, land-transportation or marine propulsion, must have a lively sense of the reality of mass. Even the bridge-engineer, dealing largely with statics, must have a conception of moving loads as something quite distinct and different from weight, a conception much more realistic than any mere mathematical formula will give. He must *feel* and *see*, in his understanding, the quantities of mass with which he deals, although no one of the five senses can perceive them, or he fails.

Yet mass "cannot be measured in feet nor weighed in pounds." The unit of mass is defined as that quantity of matter which, in gaining a velocity of one foot-per-second-squared, absorbs 0.5 ft.-lbs. of work.

The unit of entropy is defined as that quantity of matter which, in gaining 1° F. (which the physicists assure us is velocity-squared), absorbs 778 ft.-lbs. of work; it being also provided that the rise in temperature shall be gained by absorption of *work*, not of *heat*.

These two definitions are exactly parallel. Neither carries to the intelligence, by its literal form, any "entity cognizable by the senses," as your reviewer demands. A great many engineers have no such real idea of mass as its definition, "the unchangeable in matter," warrants. Such a person cannot possibly gain a living conception of entropy. Some people are able to see a 500-lb. projectile from a 10-in. rifle strike a smashing blow, with no more useful idea of the occurrence than that it is "a 500-lb. blow," with no grasp whatever of the fact that the same projectile, going at the same speed, would strike the same blow on the surface of the moon where it could be lifted by one hand, or at the surface of the sun where its weight would be too great for any human appliance to lift it. Such a person regards mass as merely W divided by g. The same mind necessarily regards entropy as merely Q divided by T. Words need not be wasted in condemning both attitudes as insufficient.

The truth about the gun and the projectile is that in the former we have a true adiabatic process. The molecular projectiles constituting the highly-heated gases resulting from explosive combustion bombard the gun-projectile and give up to it their energy by losing their velocity at constant mass—or, in other words, by losing their temperature at constant entropy—while the gun-projectile gains velocity at constant mass. Stated in this way the adiabatic process is as simple and comprehensible as the interchange of energy between two billiard balls. Go at the same process with the standard thermodynamic arguments—including the premises that entropy cannot be proved to be anything else than a mathematical function because it isn't anything else—and no useful idea whatever is gained.

Your reviewer's quotations from my steam tables prove only that he has not read all of my statements. The proportion of the mass of any body which is concerned in thermal motion, and which is therefore entropy, is variable with every change of the body's thermal condition. The mixing of the two pounds of water, resulting in an increase of entropy, merely shows that a different portion of the mass of the two pounds has become involved in thermal motion.

It is now many years since Tyndall gave to the scientific world the conception of heat as a mode of motion. The idea has never been shaken. It is time, however, that it was usefully adopted. Yours truly,

Sidney A. Reeve.

Worcester Polytechnic Institute,
Worcester, Mass., Feb. 27, 1903.

(We give space to the above letter as a matter of fairness to the author of the book; but we hereby warn any other correspondents who desire to further discuss the enticing subject of entropy that our space is not open to them. As the writer of the above letter himself says: "A great many engineers . . . cannot possibly gain a living conception of entropy." We subscribe to a hearty belief in this proposition and promise to permit no such impossible task to be undertaken in this journal.

In support of our assertion that entropy is a purely mathematical quantity, we venture to quote here from a recent paper by Prof. John Perry, one of the ablest of English engineering educators. The editor of "The Engineer" (London) recently submitted to Professor Perry several requests for a simple explanation of the term entropy, and we quote an extract from his reply as follows:

If a certain quantity of fluid stuff does work or has work done upon it, receives heat or gives it out, various diagrams on squared paper enable us to specify its changing state. We may usually employ any two of these five p, θ, v, E, ϕ as the co-ordinates, where p is its pressure, θ its absolute temperature, v its volume, E its intrinsic energy, ϕ its entropy. . . . . .

If a man asks me, What is ϕ? I can only say, ϕ is the abscissa of a diagram whose area is H and of which θ is the ordinate, just as v is the abscissa of a diagram whose area is w and of which p is the ordinate.

But if I am asked by some absurd persons like those who are writing in the papers just now, "Is entropy like fuller's earth? Is it an energy? Is it heat? Is it a dumpling? Can you not tell a thick-headed person like me what it is without introducing symbols like $\int$ and d H, and without insisting on our drawing diagrams and studying the matter?"—if I am asked these questions, I answer that I cannot do what is impossible. Entropy is not heat, it is not any form of energy or a pudding.

While this subject is under discussion, we cannot refrain from expressing commiseration for those students in the engineering schools who are being compelled to study some of the transcendental mathematics now in vogue, whether they are endowed by nature with a high degree of mathematical ability or not. The warning of one of our ablest engineering educators in a published address a few years ago ought to be heeded: "Mathematics too often beclouds the brain whose tool it is."

The engineering school should have just two great purposes in view: To teach engineering and to educate men. We fail to see how some of the ultra-refinements in mathematics which are forced on students at some of our schools can conduce to either of these ends. Many of the boys may endure it without injury, as did the boys at Dotheboys Hall Mrs. Squeers' doses of sulphur and treacle; but the point is whether the time spent in this way makes them either abler engineers or broader and better men.—Ed.)

Hall's Descriptive Geometry.

Reviewed by Henry S. Jacoby.*

DESCRIPTIVE GEOMETRY.—With Numerous Problems and Practical Applications. By William S. Hall, C.E., Professor of Graphics and Mining in Lafayette College, Easton, Pa. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 76, also 12 × 17-in. portfolio, with 12 pp. of text and 18 plates. $3.50 net.

Chap. I. of this book gives the definitions, methods of representation, notation and conventions; Chap. II., the problems of the point, line and plane; Chap. III., the construction of various curves and their tangents; and Chap. IV., the projections of cylinders, cones, surfaces of revolution and warped surfaces, together with problems relating to intersections and developments, and their tangent lines and planes.

The text covers about the same topics as Part I. of Church's Descriptive Geometry, with the addition, however, of nine curves in Chapter III., including trochoids, spirals and other curves mainly applied in mechanical engineering; while in Chapter IV. brief notes are introduced on the construction of several additional warped surfaces. It has also about the same scope as Watson's text-book, with the omission of the general method of changing the co-ordinate planes, and of spherical projections.

The author deserves commendation for adopting the very convenient modern notation introduced by Watson in 1873, while several books on this subject, published within the last few years, still continue the old notation. Whenever the detailed construction of problems is given it is preceded by a brief but clear analysis, and in this respect follows the admirable method of Church. In some cases the analysis, only, is given, the student being expected to supply the construction, while in still others the entire solution is left to the student.

The distinctive feature of this new work consists of 194 problems printed on twelve loose sheets for classroom use at the blackboard. Most of the problems are arranged with several modifications in the data, so that different work may be readily assigned to the members of the class. This also prevents the student from repeating the construction shown on the published diagrams. The problems are so varied as to give practice with projections in the four diedral angles. The practical applications noted in the title page are mostly limited to brief references to the industrial applications of different curves and surfaces, while in a few of the problems the application is included in the statement of the problem.

Without intending the following criticism to be directed against the text-book under review any more than against all the rest which have been published during the past fifteen years, and are now in use, it may be well to point out that no marked improvement is apparent in the presentation of descriptive geometry during this period. The subject is a difficult one to most students, because it appeals so largely to the imagination. Its value as general training, apart from its importance to engineering and architectural students in designing, is such that every effort ought to be made to improve the methods of instruction in the subject. The principal difficulty is met in the very beginning of the course, and the text-books are notably deficient in adequate details to aid in developing the fundamental principles and methods, and in connecting them with the preceding geometrical studies.

They also fail to show that any attempt has been made for a long time to arrange all of the problems in a logical order. This applies especially to the elementary problems, involving the relations of the point, line and plane, practically the same order of treatment being copied without investigation in this respect. This may be illustrated by referring to the problems usually placed at the beginning of the chapter on these elementary relations. Finding the traces of a line whose projections are given (and the converse) is immediately followed by the determination of the length of a line by revolution. These problems have no connection and should be widely separated. Logically and naturally, the problems involving the use of traces, and without introducing radically different ideas, such as passing planes through lines, and finding the line of intersection of planes, should follow the determination of traces. The ordinary arrangement introduces so many unrelated ideas to the student during the first few exercises as to confuse his mind unnecessarily. Many other examples of a similar nature might be given, but this one is sufficient to call attention to the subject as one which deserves careful consideration.

The publication of this work in two volumes, one of which is large and unwieldy, makes it unnecessarily expensive and inconvenient. On the whole, it would seem to be better to distribute the illustrations throughout the text as needed, and to print the problems on smaller sheets that might be put in a pocket attached to the inside of the rear cover. Their reduction in size would not only make them more convenient to handle at

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the blackboard, but would materially reduce their liability to excessive wear. It should be remarked, however, that the illustrations are excellent, the engravings being made by the wax process, and well printed.

Diamond Mines and Mining in South Africa as Seen by a Mine Manager.

THE DIAMOND MINES OF SOUTH AFRICA.—Some Account of Their Rise and Development. By Gardner F. Williams, M. A., General Manager of De Beers Consolidated Mines. New York and London: The Macmillan Co. Cloth; 7 × 10 ins.; pp. 681; maps, photogravures and many other illustrations. $10 net.

For the past fifteen years the author of this book has been the general manager of De Beers Consolidated Mines, Ltd. He therefore writes with a knowledge of his subject that should make both interesting and instructive reading—not only for the mining engineer but for any one interested at all in diamond production; and in our expectation of what the book should be we are not disappointed by what it is.

The opening chapters are more interesting than a work of fiction, for, in tracing the history of the early diamond seekers and their battles with nature and natives, we have a narrative most fascinating because it is true. One thrilling word picture of a battle between Boers and Zulus we cannot refrain from quoting in part:

Flushed with this bloodshed, he (Umsilikazi) made a swoop with 6,000 men upon a part of Potgieter's trek—a company of a few score men, women and children. But the startled Boers were now on their guard. They ranged their big, white-tented wagons in a square, lashing the wheels together with rawhide reins, filling in the chinks in their barricade with thorny mimosa bushes . . . Upon sight of the advancing Matabele, all knelt and prayed. Then some of the men rode out boldly to meet the attack with their heavy rifles. . . . Within the laager all was made ready for a defence to the death. Back of every wagon a little heap of powder and bullets was put on the ground, and the women stood by to hand spare guns and reload. It was sternly ordered that there should be no shrieking or crying by women or children. In silence the rush of the Matabele was awaited.

On came the impis in raging masses that dashed on every side of the laager like surf on a reef, wrenching at the wheels, clambering over the canvas, plunging through the thorns. The heavy wagons were shaken and swayed, but the lashed barricade held fast. The grim Boers met the shock with withering volleys, piling up the blacks in bloody heaps around the laager. . . . The surges massed against it recoiled. But, after a moment of rallying, on came the billows of men, flinging their assagais, and howling like madmen as they crashed against the barriers. They stabbed and slashed at the canvas . . . until some, torn, bloody and gasping, squirmed into the square, where the Boer women killed them with knives and hatchets. . . . So intense was the strain of that hour that even these men of iron nerve were entranced. "Of that fight," wrote one, "nothing remains in my memory save shouting and tumult and lamentation, and a dense smoke that rose straight as a plumbline upwards from the ground."

Following the chapters chronicling the advance of these early settlers comes an account of the discovery of the first diamonds, and a vivid picture of the rush of prospectors to the new fields. These first diggings were placer mines, for the existence of diamonds away from the river gravels was not suspected. Later, when garnets were noticed on a certain Boer farm, diamonds were looked for and found. This was in 1870, and marked the beginning of the great rush to Kimberley.

The history of the early mining is given in detail and profusely illustrated with photogravures and half-tones. Then follows an equally detailed description of the deep open-cut mining in the diamond craters, and the development of that wonderful system of wire-rope tramways that made the mines look like the cobwebs of a spider's nest.

By the end of the year 1882 this open pit method of mining had almost come to an end, due to the caving-in of the country rock, and the first shaft sinking was begun. The numerous photographs illustrating mining appliances—and, indeed, the photographs so profusely used throughout the book—give not only a popular interest to the work, but have their scientific value as well.

Having now passed through eight chapters and 266 pages, we come to a chapter on "The Moving Men," in which is given a brief history of Barney Barnato and Cecil Rhodes. This is one of the most interesting chapters in the book, nor is it without instructive features, for to read how men have done great deeds often inspires the doing of deeds equally great. Here and in later chapters is made clear the fact that the ambition of Cecil Rhodes was to win Africa for the British Empire. How well he succeeded in that ambition is now a matter of history.

In the year 1887 the author was placed in charge of the De Beers mine. He describes the new system of mining that he developed; it being a system whereby all the "blue ground" bearing the diamonds is removed by overhand stoping, retreating from the country rock wall farthest from the shaft, and allowing the broken or caved-in country rock to run into and fill up the stopes. The levels are 40 ft. apart. Speaking of the early use of flat ropes for hoisting the author says:

The only excuse I can offer for having adopted flat ropes for winding is that I was persuaded to do so against my own judgment by a number of American engineers, and experience proved that I erred in so doing. Leaving all other disadvantages aside, and they are many, the extra cost of ropes per load is sufficient to condemn the flat rope.

But if the author was misled by American engineers, he later showed no prejudice against American practice, for he adopted the "Whiting system," first used by Mr. S. B. Whiting, general manager of the Calumet & Hecla Copper Co., of Michigan.

The methods of draining, lighting and ventilating the mines are described, but not in much detail.

One of the most instructive chapters of the book is the one on "Winning the Diamonds," wherein is described the method of harrowing the blue ground as it lies exposed on the depositing floors. These floors are simply the natural soil cleared and well rolled, and at the De Beers mine the floors occupy an area of about two square miles. The "blue," to a depth of about a foot, lies exposed on the floors from four to six months until thoroughly disintegrated. The author remarks that in all the time he has been in charge of the De Beers mines he has never found a diamond on the floors. This is hardly to be marveled at when later he tells us that from a solid cube of the "blue," 430 ft. on a side, the diamonds extracted would be contained in a box 2 ft. 9 ins. on a side, which is a year's output.

The washing machines are next described, and of these by far the most interesting is the automatic diamond sorter called the "Greaser."

A coat of thick grease on the surface of a percussion table adheres to the diamonds and to diamonds alone, permitting pyrope, zircon, mica, magnetite, pyrite and other concentrates to be washed off the table, but holding fast to the diamonds. Glass thrown on these Greasers passes off with the tailings also. The author says that the action of the Greaser may possibly be due to the fact that water adheres to or enters the pores of all minerals except precious stones, which, remaining dry, adhere to grease.

An interesting chapter is devoted to a description of the native workers, how they are housed and managed, their efficiency, etc.; and another chapter describes the mining towns.

The formation of the diamond is next discussed and every theory is severely criticised. The author closes by saying:

I have been frequently asked, "What is your theory of the original crystallization of the diamond?" and the answer has always been, "I have none; for after 17 years of thoughtful study, coupled with practical research, I find that it is easier to 'drive a coach and four' through most theories which have been propounded than to suggest one which would be based upon any more unassailable data."

The diamond market and the cutting of diamonds are treated in a general way, some data being incidentally given, after which comes the final chapter, "An Uplifting Power," in which Cecil Rhodes is eulogized for his great work in Africa.

The Appendix consists largely of a history of the siege of Kimberley; and a most interesting and accurate account is given of events from the first day of the siege up to the arrival of General French.

It is to be regretted that a book containing so much that is of interest and of value both to lay readers and to engineers should be limited in its distribution, as it will be on account of its price.

Zinc and the Zinc Industry.

PRODUCTION AND PROPERTIES OF ZINC.—By Walter Renton Ingalls. New York: The Engineering and Mining Journal. Cloth; 6 × 9 ins.; pp. 328; 66 illustrations. $3.

The author states in his preface that it has been his aim to present a comprehensive review of the world's resources of zinc ore, the conditions of its production, the concentration of the crude ore into a smeltable product, and a summary of the statistics of the zinc industry from the earliest records down to the present time. In the opening chapter the history of the zinc industry is briefly given. In the second chapter present economic conditions are discussed, lists of European and American smelters being given. Ore and fuel supplies of foreign and home zinc districts are followed by data of costs of mining, etc.

Chapter III. gives data as to the uses of zinc and zinc products, and is followed by another statistical chapter giving production and prices in all countries for a long term of years.

"Analysis of Zinc Ores and Products" is a 39-page chapter that adds little if any value to the book as a whole, for assaying or analysis is hardly a subject coming within the scope of the title of the book.

Ores of zinc, properties of zinc, and chemistry of zinc compounds are treated in three chapters, and although the discussion is good, it is too brief—which would not have been the case had the preceding chapter on zinc analysis been omitted to give place to matter more properly coming within these chapters. For example, there is but one page given to the very important subject of heat-formation of various zinc salts, and nothing as to their specific heat. The author would have done a good work had he gone far enough to indicate the practical value of thermal chemistry in relation to zinc compounds, for it is a subject treated in no American work in particular. We may note in passing that the author would have done well to adhere to the chemical notation of Thomsen and others, using a comma to connect the H_2O (water of hydration) with the anhydrous elements of a salt, instead of the + sign used.

Two chapters follow on the occurrence of zinc ores in America and other countries; then comes perhaps the best chapter (pp. 57) in the book, "Mechanical Concentration of Zinc Ores." The literature of the subject has evidently been gone over with care, and a compilation made so as to give a short but comprehensive discussion. Costs and other data of milling are given, but not in much detail. The final chapter treats of ore sampling and valuation.

As we look back through the pages of this book we see that it will best serve the lay reader or the mining man who seeks a general rather than a detailed knowledge of the subject. It is true that the statistical data will meet the requirements of almost any one; but aside from that the work will be rather disappointing to the mining engineer. Moreover, we cannot see where the author has added much to the world's stock of technical knowledge. He appears rather to have made a compilation, often too technical for the lay reader, but seldom technical enough for the technical reader. Perhaps it is asking too much that the first American treatise on zinc be more than a general review of the subject, but it is surely disappointing to any who have looked for a book on zinc at all comparable with Peters on Copper Smelting.

BLACKWELL'S ISLAND BRIDGE, NEW YORK CITY.—By Gustav Lindenthal, Commissioner of Bridges. New York: Engineering News Publishing Co. Heavy paper; 24 × 15 ins.; one page of text and six plates. 60 cts.

This is a portfolio of half-tone plates illustrating the new bridge being built across the East River at Blackwell's Island, New York city. The views comprise a wash drawing of the whole structure in perspective and several similar drawings of the anchor piers, entrance portals and main towers, a perspective looking from beneath the bridge and several photographs of the substructure work in progress. A page of text by Mr. Lindenthal describes the main structural features of the bridge and gives its principal dimensions.

A Notable Treatise on Iron and Steel Manufacture.

THE MANUFACTURE AND PROPERTIES OF IRON AND STEEL.—By Harry Huse Campbell, M. Am. Soc. C. E., M. Am. Inst. M. E., General Manager Pennsylvania Steel Co. New York: The Engineering and Mining Journal. Cloth; 6 × 9 ins.; pp. 862; many tables and illustrations. $5.

This work is in part a second edition of the author's book on "Structural Steel," issued in 1896, but it is practically a new work, since it contains more than double the number of pages of the old one, and the subject is enlarged so as to cover all kinds of iron and steel. The matter that was in the old book has also been revised, and some chapters entirely rewritten. The book now constitutes the best and most important work on its subject in the English language.

An introduction of 30 pages gives a brief statement of the leading principles of the manufacture and properties of steel in language suitable for the non-technical reader. The portion relating to "inspection," however, is one that should be read by everyone who has business with steel works. In it the author exposes some of the tricks of the trade, and does not hesitate to speak in strong terms of the dishonesty of manufacturers and of their open disregard of specifications.

In the first chapter the author discusses the "Errancy of Scientific Records," and proves from numerous tests that "we are justified in doubting any chemical determination." The next chapter treats of the blast furnace, the ores, fuel and limestone used, the construction of the furnace, the chemical theory of its operation; the utilization of its waste heat, etc. The chemical phenomena taking place in different parts of the furnace are clearly shown by a new graphical method. This chapter occupies 80 pages, and it contains more detailed and important information concerning blast furnace theory and practice than can be found in many whole books on the subject. The use of gas engines for blowing engines is described, and it is shown that by their use a furnace producing 300 tons of iron per day would have a surplus of 2,700 HP. to dispose of.

We regret to see that the author mixes up the English and metric systems of weights and measures in this chapter. In one table he gives in the headings of columns, lbs. of coke per ton of 2,240 lbs. of iron, kilogrammes of carbon per ton of iron, cubic meters of gases per ton of iron, and heat value of gases per ton of 2,240 lbs. iron in French calories. In a foot-note he refers to an error made by Sir Lowthian Bell in giving calories per ton instead of calories per 20 kg., which arose from his adopting a new unit of 20 kg. as his base of calculation. Mr. Campbell may not have made any similar error himself, but his use of tons, pounds, kilogrammes, cubic feet and cubic meters indiscriminately makes hard reading, and is a fine sample of what we shall have to submit to for many years to come until the metric advocates cease their attempts to destroy the English system of measurement and to introduce confusion in our language. We suggest also that it would have been simpler to make all calorific computations of blast-furnace problems in weights instead of part weight and part volume. The volume calculations, cubic feet and cubic meters, always refer to volumes at some standard temperature (32°, 39° 4, or 62° F.) and not to the actual volumes, while weights are independent of temperature. Only one unit, the pound, need then be used in all calorific computations.

The last section of this chapter, on the relation between the physical and chemical properties of cast iron, is fragmentary and unsatisfactory, but this is not to be wondered at, for the existing literature on this subject is abstruse, contradictory and lacking in clearness, and it is not possible in five pages to make an understandable abstract of it. An example of the existing state of our knowledge (?) on the subject is found in the following paragraphs:

> The contention that graphite weakens and embrittles cast iron is directly opposed to the views of most practical men, but it seems as if he (Professor Howe) has made a good argument. . . . This toughening is usually ascribed to graphite, when in reality the graphite weakens the iron by destroying its continuity, but the injury caused in this way is entirely overshadowed by the fact that as long as it exists as graphite it cannot at the same time exist as cementite. Thus an element like silicon will toughen iron because it drives the carbon into the condition of graphite, while manganese will make it brittle because it causes it to combine.
>
> It is a generally accepted theory, although not undisputed, that charcoal pig iron contains less carbon than coke iron. Professor Howe states that the evidence on this point is inconclusive.

The third chapter, on wrought iron, occupies only ten pages, but it treats the subject in a satisfactory manner. After a description of the puddling process, the effects of chemical composition, of temperature of the furnace, and of work upon the character of iron are set forth. The author next discusses what is now ancient history, the controversy over the nomenclature of iron and steel, and defines wrought iron as the product of the puddling furnace or the sinking fire, and steel as the product of the crucible, converter or open-hearth steel process. Chap. V. treats briefly of the manufacture and properties of high carbon crucible and open-hearth steel. The variations in composition of these steels are shown. This is followed by 20 pages on the Acid Bessemer process. The construction of a converter, the chemical history of a charge, Swedish Bessemer practice, history of the slag in the converter, the calorific history of the converter, the use of metal direct from the blast furnace, and recarburization are the principal branches of the subject of this chapter. The basic Bessemer process comes next, and is dispoesed of in 12 pages, after which 45 pages are given to the open-hearth furnace. The latter chapter is full of information on the construction of different styles of furnace, and contains a mathematical investigation of the distribution of heat in operating a furnace.

Chap. IX. is on the combustion of fuel. Here the author again uses the metric system, with its kilogrammes, cubic meters and calorics, where pounds, cubic feet and British thermal units would have been just as good, and more acceptable to the English reader. This chapter treats also of producers and of the use of natural gas, water gas and oil. Heating furnaces, including the continuous furnace, are also described. Chaps. X. and XI. describe the operation of the acid and basic open-hearth processes, and Chap. XII., special methods of manufacture and some items affecting the cost, including the manufacture of low phosphorus acid open-hearth steel at Steelton, the pig-and-ore process, the Talbot process, and the Bertrand-Thiel process, both of which are criticised by the author, and the duplex, or combined Bessemer and open-hearth process, which is condemned on account of its making steel more costly than either single process.

The next subject discussed is segregation and homogeneity. Several tables are here given showing the variation in the composition and the strength of steel from different parts of the same ingot or the same heat. The author shows that a degree of uniformity sufficient for practical needs may be obtained if the initial metal is low in phosphorus and sulphur. Chap. XIV. treats of the influence of hot working on steel, and Chap. XV. is on heat treatment. In the latter the "critical point" and microscopic investigations are discussed, and the recent language of the micrometallographists, with its ferrite, cementite, pearlite, martensite, etc., is indulged in.

"The History and Shape of the Test-piece" make a chapter of 34 pages, containing an elaborate investigation of the variations in ultimate strength, elastic limit, elongation, and reduction of area, due to differences in size and shape of the test-piece, amount of work or reduction of section from ingot to bar, in finishing temperature, in speed of the testing machine, and in method of measuring. It is probably the most complete examination of this complex subject that has ever been published, and is worthy of careful study.

The results of the extensive research on the influence of certain elements on the physical properties of steel are presented in 67 pages. The author critically reviews the work of Howe and Webster on this subject, and discusses at great length the results of tests of many thousand heats made at Steelton, using the method of least squares to obtain final formulæ for steels of 0.35 carbon or less, which are as follows:

Tensile strength, lbs. per sq. in.:

Acid steel = 38,600 + 121 C + 89 P + R;

Basic steel = 37,430 + 95 C + 8.5 Mn + 105 P + R.

in which C, P, and Mn represent .001% of carbon, phosphorus and manganese, respectively, and R a quantity which varies in accordance with the conditions of rolling and the thickness of the piece. The value of R is taken at 0 for the ordinary conditions under which the tests were made. The author says that every open-hearth heat made at Steelton for many years has been calculated according to these formulæ, and every one has come out within 2,500 lbs. of the actual strength as determined by breaking test, except the steels containing over 0.60% Mn.

In a chapter dealing with the classification of and the specification for structural steels the author gives the opinions of several authorities to the effect that open-hearth steel is more reliable, that is, less liable to accidental failures, than Bessemer steel. This chapter contains the author's views as to specifications, together with a reprint of the specifications recently issued by the American Society for Testing Materials. Welding comes next. The author does not go as far as some writers, who say that "steel cannot be welded," but his opinion is nearly to the same effect. Experiments made under his direction by skilled blacksmiths, with the most favorable conditions, showed a total lack of certainty and regularity in the results. In a few tests only the strength of the weld was equal to that of the original bar, while in others the weld had as low as only 44% of the strength of the original.

Regarding steel castings the author points out the "deliberate fraud" of some parties who make castings from a mixture of pig iron and steel melted in a cupola and sold as "steel castings." He calls this product a "hybrid metal" which is useful for special purposes, but is fundamentally different from any kind of steel. The chapter briefly discusses the qualities and methods of manufacture of steel castings by the open-hearth process.

Chaps. XXI. to XXXIII., covering 238 pages, conclude the book, with a review of the present condition of the iron industry of the leading nations, and with statistics of the world's production. Mr. Campbell visited many of the large plants in England, Belgium, Germany and Austria in 1897, and his observations led to his forming strong opinions on many subjects which he expresses in forcible style. The differences in the mental peculiarities of the men of the different countries is clearly shown to be a chief cause of the difference in practice and in rate of progress. On the continent, if not in England, the American idea of push and change is now making rapid progress. The author says:

> She [Europe] has engineers who are as bright and smart as any in America; they are as progressive as any of our nation; they are working along many lines; they are introducing many labor-saving devices; they are building mammoth mills and great machine shops; they are not narrow; they are copying America where America is good; they are filling their machine shops with American tools, and they are taking a fresh start. In Austria a grand transformation scene is in progress: A syndicate controlling most of the iron and steel works of the kingdom is dismantling and abandoning most of them and concentrating the work into a few plants, which are being reconstructed, and rebuilt with a thoroughness that we think is characteristically American. In Germany they are doing and have done the same thing; but in Europe these improvements are not always announced to the world with a flourish of trumpets.

The labor question is discussed at some length, and the author's views are especially valuable since they are written from the standpoint of one who has risen in 20 years from a subordinate position in the steel works to that of general manager, and during all that time has been in direct contact with the question. Nearly all our literature on the subject is from the hands of college professors, editors, and writers of books, and they do not get their ideas from experience. The author describes three systems of arranging relations between the employer and employed. The first is the paternal system, that of Pullman and of Creusot, which "breeds a servile lot of men, whose highest thought is expecting the next spoonful of gruel." The second is the treatment of men as men; the man is "a free agent, able to make his own contracts, to work or to leave, and as a rule he generally has a job and is too busy to make speeches on the labor question."

> The third system is the labor organization where men bind themselves together and appoint a committee of those who can talk longest and whose duty it is to get all they can for "labor." These unions declare that every man is the equal of every other man—when he is not; that a fast workman shall not be allowed to do any more work than a slow workman—which would seem to be an attempt to

upset the decree of Providence; that a good workman shall not receive more than a lazy dummy—which is absurd; that labor-saving devices shall not be introduced unless the money saved is distributed among the workmen; and, worst of all, that dealings with the men shall be done through certain intermediary officers, when it is notorious that in some cases the men chosen to such office have gained power by cajolery, bribery and the lowest methods of ward politicians.

The protective tariff is also discussed, and the author is a strong advocate of it, with limitations. He expresses his opinions on the working of a tariff concisely in 15 numbered paragraphs.

The last chapters include careful statistical reviews and discussions of the conditions under which the iron manufacture is carried on in different countries. The sources of information are given in each case, and the statements concerning the iron industry of the continent have been revised by competent experts in each country before publication. The statistics have been so carefully compiled as even to show the discrepancies between the figures of different authorities. Plotted diagrams are given of the progress of coal, ore, pig iron and steel production in the leading countries from 1880 to 1901.

On the whole, Mr. Campbell's book is the most satisfactory work on iron and steel metallurgy that has appeared in many years. It will be valued by many different classes of readers, the student of methods of making iron and steel, the engineer who uses steel in his designs, and the political economist and statistician.

How to Educate Engineers.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—Proceedings of the Annual Meeting at Pittsburg, Pa., June 27 and 28, 1902; with Index, Vols. I.-X. Edited by Robert Fletcher, Calvin M. Woodward, and Clarence A. Waldo. New York: Engineering News Publishing Co. Cloth; 6 × 9 ins.; pp. 300; frontispiece and tables. $2.50.

The society very fitly commemorates its tenth anniversary by including in this volume an index 34 pages long covering the ten volumes of its proceedings. The index shows that a wide range of topics has been discussed at the various meetings by a large number of eminent engineering educators and also by engineers devoting their time to practice. The subjects range through algebra, esthetics, astronomy, chemistry, and correspondence schools, at one end of the alphabet, to testing laboratories and vacation work at the other. All the volumes in the series are printed in large, clear type, on good paper, and are uniformly bound in blue cloth.

The present volume contains a list of 278 members, of whom 247 are classed as "teachers, and, in many cases, also practicians," while 31 are "practicians not teachers." A total of 73 colleges and universities teaching engineering is included, besides 8 manual training schools, and 1 correspondence school. The membership is distributed through 37 States and the District of Columbia, besides a number of members in Canada, and one each in England and Australia. These figures indicate the representative character of the membership of the society.

Among the papers included in this volume are the following: Presidential address by Prof. Robert Fletcher, on "The Efficiency Factor in Engineering Education;" "The Value of Non-Resident Lectures on Engineering Subjects," by Profs. Wm. D. Pence, Geo. F. Swain and R. H. Thurston; "Courses of Instruction in Irrigation Engineering," by Prof. Elwood Mead; "Intercollegiate Athletics," by Prof. Calvin M. Woodward; and the "Report of the Committee on the Statistics of Engineering Education," by Profs. Edgar Marburg, C. M. Woodward, Wm. T. Magruder, and C. Frank Allen. The last-named report includes some twenty pages of statistics, showing enrollments by colleges distributed among all the various courses of study and enrollments by departments and classes.

The paper and discussion on intercollegiate athletics, while on the whole favorable to the same, deprecated many features of them, as now practiced. The author of the paper took a more favorable view of the subject than most of those who took part in the discussion. Among the latter, Prof. R. S. Woodward, of Columbia University, said that some of "our best athletes will come to my lectures and sit and sleep through a whole year." The same speaker also said that the men who really need athletics most do not join in them.

The Life and Work of an American Landscape Architect.

CHARLES ELIOT, LANDSCAPE ARCHITECT.—Charles W. Eliot, Editor. Boston and New York: Houghton, Mifflin & Co. Cloth; 6 × 9 ins.; pp. 770; many full page and text illustrations, and two folding maps in pockets. $3.50 net.

In presenting to the public this fitting memorial of a talented son whose activities were suddenly brought to a close just as he was well entered into a most promising and useful field of professional work President Eliot has done much to advance the art to which the life of his son was devoted. In brief, we have here the story of the professional training and work of a landscape architect, told, so far as possible, from his own letters and journals, combined with a collection of various essays, addresses and published reports. The whole is supplemented by reproductions of sketches, plans, and photographs illustrating observations abroad and at home, and also the work actually planned and accomplished after entering on professional practice. Born at Cambridge late in 1859, and graduating from Harvard University in 1882, Charles Eliot decided in the latter year to devote his life to landscape architecture. At that time, President Eliot states,

the profession of landscape architecture was hardly recognized in the United States, and there was no regular process of preparing for it. There was no established school for the profession in any American university, and, indeed, not even a single course of instruction which dealt with the art of improving landscape for human use and enjoyment, or with practical methods of creating and improving gardens, country seats and public parks.

As the best course to pursue under the circumstances, the young man entered Bussey Institution, the Department of Agriculture and Horticulture of Harvard University, which afforded much instruction in some of the fundamentals of landscape art. Here he studied agricultural chemistry, horticulture, applied zoölogy, botany and entomology, farm management and topographical surveying. After nearly a year (academic) so spent young Eliot entered the office of Frederick Law Olmsted, where he had about two years of varied practical work under one of the most notable American landscape architects this country has yet produced. After a few weeks on a southern trip to study mountain scenery and vegetation Eliot went abroad, where he spent nearly a year visiting scores of parks, gardens and estates, taking notes, making sketches, and reading and collecting books on his chosen profession. His journals and letters during this period are filled with keen comment and appreciation. For instance, commenting on what he saw at the "Rookery," the home of Malthus, author of the "Essay on Population," and also translator of Girardin's "Essay on Landscape," the journal says:

All in all, this is a spot which art of man has made more beautiful, and much more characteristically expressive, than ever it could have been in its natural condition. Is not this the true object of real landscape gardening?

Altogether about 150 pages are devoted to this European trip, and much of the space is occupied with descriptions of and comments on the landscape work which he saw.

In December, 1886, Charles Eliot opened an office in Boston, and for the next six or seven years he continued an independent practice, writing many articles on landscape art, and doing much in other ways to awaken an interest in the subject. In the early nineties he was largely instrumental in organizing two most important movements, one for the acquisition and improvement of public reservations, and the other for the establishment of the Metropolitan Park system. Both of these proved eminently successful, and the young man was chosen as landscape architect for the latter. After joining the Olmsteds, in March, 1893, thus forming the firm of Olmsted, Olmsted & Eliot, the firm became officially known as landscape architects for the park system, but the work was always assigned to the junior member.

It is impossible to follow the further course of Eliot's work except in the barest outline. A large part of his time was occupied with studies, plans, and their execution for the Metropolitan Park system, but in addition much work on a less extensive scale was carried to a successful issue, and writings for the public and in behalf of outdoor art and life were continued.

The reports and letters written by Eliot in behalf of the Metropolitan Park system fill many pages of this volume. The quality of these reports, as it impressed the present writer a number of years ago, may be partly indicated by a quotation from Engineering News of March 31, 1898. The quotation also contains some comment on the Metropolitan Park system, and is as follows:

The report of the board for 1897 includes a reprint of the text of a report made in 1893 by the late Charles Eliot, Landscape Architect, on the needs and possibilities of the park and parkway system now being carried out. This report was written in a simple, straightforward way, but with a grace of expression that seems to have been inspired by the beauties of the scenery for the preservation and greater accessibility of which the author was pleading. It is just this, the preservation of natural scenery and the making it readily accessible, that underlies the work recommended and carried out, and not any elaborate attempts at landscape architecture. Nature had lavishly played the part of architect. Man was about to lay ruthless hands on nature's work. The only action needed was the purchase and reservation of the land for the public use and the construction of ways to approach and traverse it. These ways have been made a harmonious part of the whole, binding all together. Aside from the parkways, where landscape work has been carried out, it has been more particularly directed to forming screens to hide the inharmonious works of man, or to restore what man has destroyed, such as the fringe of trees along river banks. All in all, the report of Mr. Eliot, aside from its suggestiveness, deserves from its grace of style to rank as real literature, using that word in its highest sense.

It may be fitly noted here that Mr. Frederick Law Olmsted, as early as 1886, urged Charles Eliot to write for the public, and stated that by so doing Eliot could serve his profession "better than any living English-writing man." We call particular attention to this matter, because engineers and engineering schools need to have brought home to them at frequent intervals the value of clear thinking and writing as means of benefiting themselves, their profession, and the public.

We wish that space permitted the use of a number of quotations to illustrate not only Eliot's convincing arguments and literary style, but also some of his discussions of the function of the landscape architect, and his relations to the building architect, the engineer, the nurseryman and what we may term the cultural gardener. One sentence, only, will be given, and that to show how in landscape work utility and beauty ought go hand in hand:

It is the calling and duty of the conscientious landscape architect to devise ways of arranging land and its accompanying landscape so that, whatever the particular purpose in view may be, the result shall be as thoroughly convenient, and at the same time as thoroughly beautiful, as possible.

The subject of one of Eliot's essays was "What Would Be Fair Must Be Fit." Certainly this is a text and a sermon in itself.

Charles Eliot died in March, 1897, shortly after having taken a severe cold while at work in Keney Park, Hartford, Conn. No one can say what he might have achieved for landscape art in America had he lived longer; but in the 38 years of his life he did far more for his country and his profession than it falls to the lot of most men to accomplish. The good that he did will be, we trust in abundant measure, continued for many years to come by this volume on his life and work.

Valuable Specifications for Cast-Iron Pipe.

STANDARD SPECIFICATIONS FOR CAST-IRON PIPE AND SPECIAL CASTINGS.—Adopted Sept. 10, 1902, by the New England Water-Works Association. Boston: Willard Kent, Secretary. Paper; 6 × 9 ins.; pp. 36; tables and illustrations. 10 cts.

We are pleased to note that these specifications are now available at a merely nominal price to all having occasion to use them. The specifications were prepared without sparing time or trouble by a committee consisting of Messrs. Freeman C. Coffin, M. Am. Soc. C. E., of Boston; Dexter Brackett, M. Am. Soc. C. E., Engineer of the Distribution Department of the Metropolitan Water District, Boston, and F. F. Forbes, Superintendent of the Water-Works of Brookline, Mass. Conferences were had with a number of manufacturers of cast-iron pipe, and a preliminary draft of the specifications was discussed at several meetings of the association. The specifications proper occupy seven pages, and are followed by tables, illustrated by appropriate diagrams, showing the general dimensions and weights of pipes and special castings of various sizes. The specials include ¼, ⅛, 1-16, 1-32, and 1-64 curves; three and four-way, Y, and blow-off branches, the latter

without and with manholes; two types of reducers; sleeves; caps, plugs, offsets; manhole pipes, and lugs on outlets of different sizes. The preliminary report of the committee was published in Engineering News of Dec. 5, 1901; one of the discussions on it was abstracted in the same journal for Dec. 19, 1901; and an abstract of the final report, with a reprint of the specifications, but including only two of the tables, appeared in Engineering News of Sept. 11, 1902. As the preparation and publication of the report has been a labor of love, and as wide circulation and use of the specifications is desirable, we heartily commend them to all engineers, water-works officials, and others who have occasion to use cast-iron pipe.

The Design and Construction of Steam Power Plants.

STEAM POWER PLANTS: THEIR DESIGN AND CONSTRUCTION.—By Henry C. Meyer, Jr., M. E. New York: McGraw Publishing Co. Cloth; 6 x 9 ins.; pp. 159; 16 folding plates, and 65 figures in the text. $2.

The preface states that frequently engineers in charge of a manufacturing business are called on to design and purchase a steam-power plant or parts of it when their knowledge of the machinery that goes into such a plant is more or less limited, and when they are not able to obtain the advice of a competent consulting engineer. This statement would be more exact if the word "willing" were substituted for "able," for there are always plenty of competent consulting engineers both able and willing to give good advice concerning the design and equipment of a power plant, and the cost of their services is usually far less than the saving in first cost and in operation of a well-designed plant, as compared with one designed by the purchaser or by the contractor. The inexactness of the statement in the preface is, however, amply compensated by the first sentence in Chapter I., which reads:

> No better service can be done the non-expert about to construct a steam plant than to advise him to engage at the outset of the project some capable engineer to design the plant and superintend its installation.

Part of the text of the book appeared as a series of articles in the "Engineering Record." These have been thoroughly revised and considerable new matter added.

The first chapter discusses the location of the plant, with reference to the distribution of the power to the locations of the demand, the cost of delivering coal and removing ashes, and the availability of water for condensing; this is followed by considerations of drawings, type of power house, building, and foundations. Chap. II. treats of proportioning the boilers, and the importance of providing sufficient grate surface is made clear. Chap. III. discusses types of boilers, and specifications for them. Chap. IV. treats of the selection of engines, dimensions of cylinders, speed, steam pressure, etc. The steam economy of the various types of engines, the advantages of condensing, superheating, steam jacketing, etc., are briefly described. Chap. V. is on specifications for engines, and a sample specification is given. Steam and water piping is the subject of the next chapter, and other chapters are devoted to condensers, feed-water heaters, economizers, mechanical draft, chimneys, coal handling, water supply and purification.

The book as a whole is well written and contains a great deal of valuable information in a small space. While the power-plant engineer will find little if anything in it that is new, he will find much that is worth his attention as a reminder of the many things that have to be considered in the work of designing. To such engineers perhaps the most useful part of the book will be the sixteen folding plates, most of which are ground plans and sectional elevations of recent plants, showing the location of boilers, engines, piping, etc. In a somewhat careful reading of the book we have noted only two slips, which the author will probably correct in the next edition. The first is on page 20, where he says that "the western coals have to be burned at a comparatively high rate of combustion, about 20 lbs. of coal per sq. ft. of grate per hour, otherwise it is difficult to keep the fire from going out." If he will visit some electric light stations in the West, after midnight, when the load is lightest, he will find western coal burning or smoldering away at only 3 or 4 lbs. per sq. ft. of grate per hour, but there is no fear of the fire going out so long as the bed of coal is thick enough and a trifling amount of air passes through it. In fact, if the coal contains much sulphur a pile of it is apt to take fire spontaneously and burn at an exceedingly slow rate. Again, in p. 21, the author says "most leading authorities unite in the belief that a higher efficiency is secured in steam boilers when operating at comparatively high rates of combustion." A reference to the discussion of Mr. W. W. Christie's paper on "Efficiency of the Boiler Grates," in the transactions of the American Society of Mechanical Engineers, will show that the authorities are not at all agreed on this matter. Mr. Christie holds that a rate of 13 lbs. per sq. ft. of grate per hour is that giving the highest efficiency, but others hold that the efficiency is independent of the rate of combustion per sq. ft. of grate, provided the grate, heating surface and draft are so related that the boiler is driven at an economical rate of evaporation.

The Elementary Details of Steam Engineering.

ELEMENTS OF STEAM ENGINEERING.—By H. W. Spangler, Professor of Dynamical Engineering in the University of Pennsylvania; Arthur M. Greene, Jr., Professor of Mechanical Engineering in the University of Missouri, and S. M. Marshall, B. S. in E. E. New York: John Wiley & Sons. Cloth; 6 x 9 ins.; pp. 275; 273 illustrations. $3.

This book is prepared for first-year students in engineering schools, and for young men in manual training schools. We are gratified to notice that it is a departure from old-time methods of teaching steam engineering, in which the student was first expected to have mastered the calculus and theoretical dynamics and kinematics, and then was dragged through a course of valve diagrams and thermodynamics before he had a chance to become familiar with an existing steam engine.

The present book gives the student pictures and brief descriptions of things he can see in out-door life, such as fuels, boilers, engines and the parts of engines, tools, even to the monkey wrench and the spanner, which are used in the engine room, piping, valves, condensers, water-columns, pumps and heaters. This we believe is the correct way to begin to teach engineering. Teach the boy about actual things first, cultivate his observing powers, get him to ask questions about the concrete things he sees, and then begin to instill theory and reasoning about the abstract things which can be mastered only by the more mature mind.

The author has made a very satisfactory selection of things to be brought to the student's attention. Three pages at first are given to a description of different kinds of fuel, and the remainder of the first chapter is devoted to the well-known modern forms of boiler grate bars, furnace doors, dampers, pipe fittings, feed, steam and check valves; pressure gages, riveted joints, stay bolts, boiler tubes, backstays, etc., are in the second chapter. We notice only one form of stoker, the Wilkinson—a few others, better known, might also have been given. The third chapter describes pumps, injectors, heaters, chimneys, forced and induced draft, damper regulators, steam piping, traps, steam separators. The next three chapters treat of the slide-valve steam engine, engine details, valve motions and the Bilgram valve diagram. The latter is the only thing in the book which involves the student in any severe mathematical thinking, but patience and a little knowledge of geometry and trigonometry will enable him to master it. Indicating and governing, governors and valves occupy the next two chapters, and condensers and multiple expansion engines the last chapter. We notice that space has been given to the Weiss counter-current condenser, a rather complicated apparatus, while the simpler Bulkley condenser, from which it is derived, is omitted.

The title of the book is scarcely descriptive—"Elements of Steam Engineering" suggests elementary theory as well as practice, but it is rather hard to suggest a good as well as a short title. What it contains is a description of the things used in a steam plant, together with a brief discussion of indicator diagrams of valve motions and valve diagrams. Perhaps the title "Elements of Steam Engineering—Description of Details" would answer, if the authors would only supplement it with another volume—"Elements of Steam Engineering—Theory and Practice." The book is a very good one as far as it goes, and we commend it for the use of beginners. The typography and illustrations are excellent.

Kinematics, as Applied to Machines and Machine Design.

KINEMATICS OF MACHINES.—An Elementary Text Book. By R. T. Durley, Professor of Mechanical Engineering, McGill University. New York: John Wiley & Sons. Cloth; 6 x 9 ins.; pp. 379; 230 illustrations in the text. $4.

In his preface the author states that this book is intended as a brief manual for engineering students, and treats chiefly of those portions of the subject of kinematics which are likely to be of assistance in the study of dynamics of machines and in work in machine design.

The method of the author is quite different from that used by earlier writers on the subject, such as Willis, Rankine and Reuleaux. Their works are generally considered by the student as a weariness to the flesh, involving too great an amount of abstract geometrical reasoning for the result to be accomplished in the limited time which can be devoted to the subject in an engineering course. Professor Durley, on the contrary, has endeavored to make the subject interesting to the student by presenting a great number of practical examples, many of them quite recent constructions, and discussing them in the simplest manner possible. He attempts no scheme of elaborate classification, as do the earlier authorities, and relegates classifications to the last chapter in the book, concluding it with the statement that "it does not seem probable that any really effective system of machine classification can be based simply on kinematic relations."

The introductory chapter defines briefly constrained motion, pairs of elements, links and chains, motion in a plane, non-plane motion, freedom and constraint, and elements and pairs in rigid and non-rigid links. Chap. II. treats of velocity and acceleration, and in addition to the usual mathematical treatment of the subjects includes graphical methods of plotting, a notable example being the diagram of velocity and progress of a certain railway train for half an hour, the abscissas representing time and the ordinates distances and speed. Another set of diagrams, taken from Engineering News, of Oct. 14, 1897, shows the displacement, velocity and acceleration of an electric street car for 20 seconds, starting from rest. Chap. III. discusses quadric crank chains, virtual centers and centrodes, and straight line motions. Practical illustrations are a feathering paddlewheel, a Roberval balance, and the Peaucellier straight line motion, which are fully discussed. Slider crank chains are treated in the next chapter, and the relative velocity and acceleration of crank-pin and crossheads of different types of engines are exemplified by diagrams and mathematical analysis. Elliptic trammels, Oldham's coupling, the Worthington high duty attachment for pumping engines, and many other practical examples of slider crank chains, are given. Chap. V. is devoted to the determination of velocity and acceleration in plane mechanisms by different methods. Bremme's valve gear, the Stephenson link motion, and the Atkinson cycle gas engine are among the practical illustrations. Chap. VI. treats of alteration of mechanisms and closure. The expansion of a crank pin into an eccentric, the valve gear of duplex pumps, the Brotherhood three-cylinder engine, and a triangular frame converting rod are shown as practical examples. Chap. VII. is devoted to constraint and velocity ratio in higher pairing involving plane motion, and treats chiefly of wheel gearing, which is quite fully discussed, but not so exhaustively as in special treatises on gearing. Wheel trams and mechanisms connecting them, and cams, are the subjects of Chap. VIII. Epicyclic gearing and many practical cams are illustrated and described in this chapter.

Ratchet wheels and escapements are treated in Chap. IX. Among the examples are the Yale lock, the Corliss valve gear, a locomotive brake, clock escapements and the Weston triplex pully block. Chap. X. is devoted to mechanisms involving non-rigid links, and includes such different things as belt and rope gearing differential pulleys, chain gearing springs, fluid links as in pumps, chamber wheel trains as in centrifugal and rotary pumps, valves and ribbon brakes. Chap. XI. is on chains involving screw motion, and contains many illustrations, among the notable ones being a rifled gun and the American underfeed stoker. Worm and spiral gearing are also treated in this chapter. Chap. XII. discusses spheric motion; and includes bevel gearing and special forms of mechanism, such as that of the Tower spherical engine, and roller and ball bearings. The latter subject is discussed in considerable detail. The concluding chapter contains a historical sketch of the literature of kinematics, and a review of the classifications attempted by earlier writers, which have all failed to come into any extensive practical use.

The author appears to be a thorough master of his subject, and has produced a most valuable book. We expect that it will take rank as a standard treatise for students. The style we believe to be clearer than that of any other book on the subject, and the illustrations and typography are exceptionally fine.

An Elementary Work on Land Drainage.

ENGINEERING FOR LAND DRAINAGE.—A Manual for Laying Out and Constructing Drains for the Improvement of Agricultural Lands. By Charles G. Elliott, M. Am. Soc. C. E. New York: John Wiley & Sons. Cloth; 5 × 7 ins.; pp. 232; 41 illustrations in the text. $1.50.

This book should serve admirably for the use of engineering students, and for intelligent farm managers and land owners; it also contains much of value for the engineer whose practice has been in other fields than land drainage. For engineers of experience, and even for engineering students at all versed in ordinary field surveying and hydraulic calculations, the book contains several chapters which will hardly be needed; but these chapters will be particularly valuable to many county and town surveyors called upon to make drainage surveys and estimates.

After a general introduction, a discussion of soils in their relation to drainage, and a statement of some of the principles on which land drainage is based, there is an elementary chapter on levelling and topography, and other chapters on engineering field work and allied subjects, including laying out drains, establishing grades, and making maps and records. These subjects cover eight chapters, after which there are chapters on "Flow of Water Through Pipe," "Size of Lateral Drains," and "Open Drains," respectively. The hydraulics of drainage are taken up in the first and third of these chapters.

For the velocity of flow in "lines of tile in which the grade of the drain and the quality of workmanship in its construction were known" Poncelets' formula,

$$V = 48 \sqrt{\frac{d\,f}{l + 54\,d}},$$

is cited with approval as a basis for calculations. In this formula the foot is employed as the unit, and d = diameter; f = total fall, and l = total length. This formula, the author states, has been checked by the current meter. For ordinary drainage canals the author gives

$$V = \sqrt{\frac{a}{p} \times 1\tfrac{1}{2}\,f},$$

in which a = area of water way; p = wet perimeter; and f = fall in feet per mile.

There are chapters, each, on the drainage of barnyards and roads, on drainage districts, on cost estimates, and on the general subject of the benefits and profits to be derived from land drainage. The chapter on drainage districts describes the method employed in making up assessment rolls therefor. The discussion of cost estimates might have been extended with profit. As it stands, it is devoted chiefly to general methods and principles. Cost figures are few, and they, also, are general. Elsewhere in the book are some other tables for making estimates, including a short one for computing ditch excavation.

The Political, Economic, and Legal Aspects of Irrigation.

IRRIGATION INSTITUTIONS.—A Discussion of the Economic and Legal Questions Created by the Growth of Irrigated Agriculture in the West. By Elwood Mead, C.E., Chief of Irrigation Investigations, U. S. Department of Agriculture. New York: The Macmillan Co. Half-leather; 5 × 8 ins.; pp. 392; illustrations. $1.25, net; by mail, $1.33.

Twenty years of practical experience and intimate knowledge of irrigation in its many and varied phases, passed as assistant State Engineer of Colorado, Territorial and State Engineer of Wyoming, Chief of the U. S. Irrigation Investigations, and Professor and Lecturer, respectively, at the universities of California and Harvard, have placed Mr. Mead in a unique position in relation to one of the greatest and most urgent problems of the day. That problem pertains neither to engineering nor finance, for both the engineer and the capitalist have been waiting some years for its solution. It is rather a matter of governmental policy, which must be established by the State and the National legislatures and courts in order to fix beyond all question the relation between water and land in the arid and semi-arid regions. The true significance of the problem is but half appreciated, in the West, while in the East only an occasional person can be found who realizes that such a problem exists. But East and West, as one common country, is vitally concerned in the development of irrigation on a sound, rational basis. Let us see how Mr. Mead treats his subject and what remedies he has to offer for the deplorable confusion of water rights which he portrays.

The book opens with a brief sketch of the conditions now existing in the arid West, and their relation to the prosperity of the whole country. At the close of this review, Mr. Mead says:

> The essence of the problem to be met at the outset is the control and distribution of the water-supply, since not only the enduring prosperity, but the very existence of the homes created will be conditioned upon the ability to use the rivers of the region for irrigation. The diverse interests of individuals and communities, and even of different states, will all depend on streams flowing from a common source. To reclaim all the land possible will involve the spreading of water over a surface as large as New England with New York added. Standing now near the beginning of things and looking down the vista of the future, we can see in the courses of these rivers the dim outline of a mighty civilization, blessed with peace, and crowned with a remarkable degree of prosperity, in case wise laws and just policies shall prevail in the years of the immediate future, while institutions are forming. But if it be otherwise—if greed and ignorance are allowed to govern, and we ignore the experience of older countries than ours—there will remain to us only a gloomy forecast of legal, economic and, possibly, civic strife.

The public land laws, both National and State, are next considered, and it is shown that through an utter lack of appreciation of the conditions prevailing in an arid country more land has been granted to individual settlers than could be properly utilized, and that speculation has been easy and rife. The evil effects of divorcing irrigable land and water, when neither is a safe investment without the other, are also pictured, together with the conflicts between agriculturalists on lands legally taken up and graziers on the open ranges. The Carey Act, permitting each arid State to assume 1,000,000 acres of public lands for irrigation and settlement, is also discussed, and while it is approved in its main features, objections are raised to the delays and formalities required to make the land available, the prohibition of community fencing, and the lack of provision for the "construction of canals under public supervision and in accordance with some comprehensive plan."

In a chapter on "The Beginnings of Irrigation" the history and methods of the earlier efforts are sketched. Then follow two important chapters on "The Doctrine of Appropriation" and "Contract Water Rights," which are admirable expositions of the general principles involved in the proper dealing with water rights and the general failure to follow those principles in this country. The measurement and the duty of water are next taken up, the latter in most detail, in order to bring out more clearly the needs and possibilities of more efficient supervision of the conservation and use of water in irrigation. Then come separate chapters on irrigation in Colorado, California, Utah, and Wyoming, and a fifth chapter in which like, but briefer, consideration is given to other States and Territories. These chapters enable the author to bring out the good and bad points in the legislation, administration, and judicial decisions of the several commonwealths. A chapter on "Riparian and Interstate Rights" contains much interesting and suggestive matter.

The final chapter is entitled "Methods and Measures Needed for Future Development." Here the author first reviews, in the light of what has preceded, the history of irrigation development during the last thirty years of the nineteenth century. From 1870 to 1890 many irrigation works were built, some of which were large and costly, and many of which turned out to be financial failures. These failures were due to a variety of causes, some general, others closely related to conditions in the irrigated West. The general causes, such as financial stringency, a reduction in both immigration and emigration, led to a shrinkage in the value of irrigation works; while defects in land laws and methods of securing and controlling water rights were additional drags upon progress. In the last ten or twelve years a readjustment has been in progress. There has been less speculation than formerly, some improvement in administration, a better union of land and water rights, a more intelligent use of water and improvements in agriculture. But there are still burdensome water contracts, costly and endless litigation, inefficient distribution and use of water, and much uncertainty regarding the parts which the National and State governments are to take in the construction of irrigation works, and in the control of interstate streams. There should be an agreement as to whether rights in water "are to be limited to needed and beneficial use, or streams are to be owned as personal property," which latter "cannot prevail without creating institutions essentially feudal in character." Ditches should be regarded as mere carriers of water, instead of allowing their owners to struggle over the division of the latter, and the division should be made by public officers. Land and water should be united. Coöperative irrigation should be encouraged. Finally, the isolation of the irrigated home may be diminished by "grouping homes in farm villages," as is already done in some localities.

A Revised and Enlarged Edition of Johnson's Contracts and Specifications.

ENGINEERING CONTRACTS AND SPECIFICATIONS.—Including a Brief Synopsis of the Law of Contracts and Illustrative Examples of the General and Technical Clauses of Various Kinds of Engineering Specifications. Designed for the use of Students, Engineers, and Contractors. By J. B. Johnson (late) Dean of the College of Mechanics and Engineering, University of Wisconsin. Third edition; revised. New York: Engineering News Publishing Co. Cloth; 6 × 9 ins.; pp. 566. $3.

In this, the third, edition of this deservedly popular book about 114 pages have been added. Most of the new matter appears in Part IV., "Illustrative Examples of Complete Contracts and Specifications," which has been thoroughly revised. The additions include specifications for Riveted Steel Water Pipe, Wooden Stave Water Pipe; Wrought Iron Chains; Railroad Concrete Work; Railway Road Beds; Levees; Steel Highway Bridges and Viaducts; Preservation of Railroad Cross Ties; Filter Gravel and Sand; Specifications and Contract for Architects' Services; and the general specifications for testing hydraulic cements adopted by the U. S. Engineer Corps. Besides adding these new specifications the author has revised those already included in the book. Two new appendices on the Engineer as an Expert Witness and the Standard Specifications for Iron and Steel proposed by the American Society for Testing Materials have also been added.

Compressed Air and Its Applications.

COMPRESSED AIR INFORMATION—Or a Cyclopedia Containing Practical Papers on the Production, Transmission, and Use of Compressed Air. Edited by W. L. Saunders, M. Am. Soc. C. E. New York: Compressed Air. Cloth; 6 × 9 ins.; pp. 1,175; 49 illustrations.

The origin and scope of this book are perhaps best indicated by quoting from the preface the following explanation by its editor:

This publication has been called for by many inquiries addressed to the editor of "Compressed Air," asking for various papers, some of them original and others compiled, which have been published in that little magazine during the first five years of its existence. The supply of the early issues having been long since exhausted and the demand continuing, an effort has been made to present in a single book of reasonable size all the important practical information contained in the first five volumes. No attempt has been made to introduce new matter, but the various papers, editorials and notes have been selected and arranged under suitable headings so that any one seeking information on this subject may be afforded facilities for finding it properly classified. The principal claim of recognition rests on the practical character of the materials, as the little magazine from which these papers have been compiled has endeavored to record the every-day experience of engineers familiar with the handling of compressed air apparatus. These experiences cover a wide field and are not simply the opinions of a few men, but those of many, hence it is believed that the collection for this data in one book will prove of service to the engineer and student.

Since "Compressed Air" itself gleans its articles largely from other technical publications, the book is actually a collection of clippings from the engineering and scientific press in general. In any such collection of articles, if they be at all well selected, there is certain to be a large amount of valuable information, and this collection is no exception to the rule. The chief drawback to the use of a collection of clippings is the enormous task of searching out the particular facts desired. This has been made considerably easier than is usually the case by providing an index, and by broadly classifying the articles contained in the book before us. In typography and printing the book is a very ordinary affair, while many of the illustrations are miserable and none are particularly good.

Directions for Railway Location and Construction.

MANUAL FOR RESIDENT ENGINEERS.—Containing General Information on Construction. By F. A. Molitor and E. J. Beard. New York: John Wiley & Sons. Cloth; 5 x 7 ins.; pp. 118; tables and illustrations.

The authors are respectively Chief Engineer and Principal Assistant Engineer of the Choctaw, Oklahoma & Gulf R. R., and the book is based upon their instructions to the resident engineers of that road, which instructions were first issued in blueprint form, and afterwards revised. After setting forth the duties of the engineer, the methods of keeping profiles and books, and the methods of preparing reports, plans and estimates, the instructions relate to grades and curves, easement and vertical curves, and then to earthwork, haul and masonry. These general instructions cover some 60 pages. Then come specifications for grading, masonry and lumber, and an abstract of the general form of contract. Earthwork tables of level cuttings, for use in preliminary work, only, cover 26 pages. The contract referred to is of the usual type, which has so often been criticised, in which the chief engineer is made sole judge and arbiter, while all responsibility is placed upon the contractor. One clause in particular states that the contractor takes the work "solely upon his own information and judgment of the character and topography of the country," etc., etc., "and without reliance upon the profile and preliminary approximate estimates of the chief engineer." The book is useful in giving an example of the form of instructions issued to engineers on railway construction work, but its scope is much more limited than that of McHenry's "Rules for Railway Location and Construction Used on the Northern Pacific Ry.," and in fact it might be considered as supplementary to the latter. The "Manual" is printed in large type, with numerous headings to facilitate reference. It might easily have been made more compact and thus more convenient for the pocket.

From St. Petersburg to Port Arthur and Pekin.

THE GREAT SIBERIAN RAILWAY.—By Michael Myers Shoemaker. New York: G. P. Putnam's Sons. Cloth; 6 x 8 ins.; pp. 243; 29 half-tone plates and folding map. $2 net.

The reader who enjoys a flippantly told story of globe-trotting, interspersed with such random and rather meaningless figures of the supposed mineral wealth and population of the countries traversed as may be taken without too much trouble from departmental reports will probably appreciate this book. As a serious consideration of the Trans-Siberian Railway, either as an engineering, military or political work, it is practically worthless. Indeed, in this respect the title of the book is a thoroughgoing misnomer. Briefly explained, the author records the experiences and observations of a journey from St. Petersburg to Port Arthur by railway, and from the latter place by steamer to Pekin. He is evidently a seasoned and philosophical traveler, with a quick eye for externals, and a vivid appreciation of "funny" persons and incidents, and he records them with a facile pen. For solid substance to balance he has depended upon the "Guide to the Great Siberian Railway," published by the Russian Ministry of Ways and Means of Communication, and thus saved himself from imbibing pessimistic views of Asiatic Russia and its great railway. The engineer will find little information regarding the Trans-Siberian Railway in this book which has not already been provided for him, in far better form for his purposes, by the engineering journals.

Proceedings of State Engineering Societies.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS.—Proceedings of the Spring Meeting at New Haven, April 20, 1901; Summer Meeting at New London and Norwich, Aug. 22, 1901; Annual Meeting at Hartford, Feb. 11, 1902. J. Frederick Jackson, Secretary, New Haven. Paper; 6 x 9 ins.; pp. 247; tables and illustrations.

At the first of the meetings reported in this volume President Hadley, of Yale University, made a brief but suggestive address on one phase of technical education which he summed up in this question:

> How can we lengthen the period of training which modern expert work demands without postponing the years of real professional success until a time so late in life that even the rich man feels the delay as a burden, and the poor man cannot afford it at all?

The answer to this question, so far as was attempted, was as follows:

> Only by bringing the work of the later days of student life into such intimate connection with that of the early days of professional life that the student shall be training himself in what is wanted, and that the office shall be able to find at the same time what men it needs for its expert work, and utilize their services promptly. But for this end we must have a far freer interchange of thought between the universities and the practical men of the country that has hitherto been possible. If the universities can know from the offices and the shops of the country more exactly the kind of men they want and the kind of training they want, the students can, during the later years of their course, be far more satisfactorily prepared for the problems with which they have to grapple; and on the other hand if the offices and shops can know from the universities what kind of men they are training, they can in turn be far surer of finding the right kind of experts instead of the wrong kind of experts for filling the positions in which scientific knowledge is valuable.

The principal papers in this report are: "Expanded Metal Construction," by Wm. M. Bailey, Assoc. M. Am. Soc. C. E.; "Æsthetic Elements in Engineering Design," by J. C. Tracy; and "The Metric System and Its Practical Application, as Compared with English Units for Linear Measurement and their Subdivision," by Geo. M. Bond, M. E. Mr. Tracy's paper was largely an analysis of the æsthetic, as exemplified by various ancient and modern writers. That it did not ignore the practical applications of the subject is shown by the author's summary of its teachings, as follows:

> (1) The increased demand for æsthetic results in engineering design will both enable and compel the engineer to pay more attention to æsthetics.
> (2) Æsthetics can furnish the engineer with no fixed rules or standards of taste, but it can suggest certain lines along which æsthetic development must take place.
> (3) Some of these lines are suggested by Utility, Stability, Proportion, Symmetry, Grace, Massiveness, Simplicity, Unity, Form, Structural Form, Details, Decoration, Color, Contrast, Vividness of Impression, Harmony, Imitation, Association, Truth, Avoidance of Shock, Novelty, Originality, Permanency, Preliminary Drawings, and Economy.

The volume contains eight committee reports, based largely on inquiries among members and others regarding current practice. The subjects thus covered are field work, electric railroads, steam railroads, office management, masonry, pavements, water supply, and sewerage. The report of the sewerage committee occupies over sixty pages, contains a wide range of information on the character and extent of sewers, the practice as to house connections and special assessments, and other matters in 37 places in Connecticut, 24 in Massachusetts, four in Rhode Island, and 17 of the larger cities elsewhere in the United States.

OHIO SOCIETY OF SURVEYORS AND CIVIL ENGINEERS.—Annual Meeting at Columbus, Jan. 21 and 22, 1902. Prof. W. H. Boughton, Secretary, Granville, O. Paper; 6 x 9 ins.; pp. 123; illustrated. 50 cts.

In a brief but good paper by Mr. E. A. Kemmler some interesting facts are given regarding the methods of recording and paying for repairs to asphalt pavements at Columbus. There is a paper by the secretary on designing riveted connections, and several papers on road construction, including general specifications for improving roads in Cuyahoga county. There is a paper by Mr. R. E. Kline on "Electric Railways Between Distant Terminals," and one by Mr. J. B. Strawn on "A Concrete Foundation Built at Youngstown, O."

INDIANA ENGINEERING SOCIETY.—Annual Meeting at Indianapolis, Ind., Jan. 29 to 31, 1902. Charles Carroll Brown, Secretary, Indianapolis. Paper; 6 x 9 ins.; pp. 242; illustrated. 50 cts.

The subject of the presidential address by Prof. W. D. Pence, of Purdue University, was "The Working Machinery of a State Engineering Society." It was a brief study of the development and the constitutions of the leading state engineering societies, under the heads, object, scope, and ways and means. The report of the committee on ways and means touched upon "(a) recent attempts to standardize methods of tests of materials, (b) new and improved materials at the disposal of the engineer, and (c) a plan for the future work of the committee." The suggestions under the latter heading included a continuance of features (a) and (b), just mentioned, and the consideration of the establishment of a central testing bureau, supported or controlled by the state, at which materials could be tested by experts at nominal cost. The members of this committee were Prof. W. K. Hatt, of Lafayette; W. K. Eldridge, of Indianapolis, and J. W. Fulwider, of Lebanon. Following the report there are papers on "Concrete," by S. B. Newberry; "Concrete Arches," by Prof. Daniel B. Luten; "Theory and Strength of Beams of Reinforced Concrete," by Prof. W. K. Hatt; and "Some Steel Concrete Construction," by A. L. Johnson. Committee reports and papers on surveying, drainage, and bridges and masonry are included in the volume, and also a group of papers on steam pollution, with particular reference to Indiana. In addition there are papers on plumbing, water measurement, water power (on the Tippecanoe River) power transmission, the steam engine, and several committee reports besides those mentioned.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.—Annual Meeting at Joliet, Jan. 22 to 24, 1902. Prof. A. L. Kuehn, Secretary, Urbana, Ill. Paper; 6 x 9 ins.; pp. 228; illustrated. 50 cts.

The most important paper in this report is one of 50 pages on "Steel Frame Mill Buildings," by Prof. M. S. Ketchum. Other papers that may be mentioned by name are: "Concrete and Melan Arches," by L. K. Sherman; "Paving Practice in Joliet," by H. A. Stevens; "Civilization and Wagon Roads," by Prof. Ira O. Baker; and "Practical Municipal Resurveys." In addition there are a number of papers, brief topical discussions and committee reports on electric railways, railway maintenance records, shrinkage of earth embankments, surveying, sewerage, water supply and other subjects.

THE MICHIGAN ENGINEER.—Proceedings of the Michigan Engineering Society for 1902. F. Hodgman, Secretary, Climax, Mich. Paper; 6 x 9 ins.; pp. 173; illustrated. $1.

This report contains the proceedings of the annual meeting of September, 1901, and the convention of January, 1902. Owing to an accident the stenographic notes were destroyed, so that only the reports and papers are given this year, without the discussions. Notes of these discussions, however, were given in the report of the convention in Engineering News of Jan. 16, 1902. The principal papers in the volume are as follows: "Electric Railways," W. J. Sherman; "The Water System of Corona, Cal.," A. L. Reed; "The Use of Concrete in Sewer Construction," Harry V. Gifford; Improvement of Channels on the Great Lakes," C. Y. Dixon; "City Water Supplies from Reservoirs Fed by Limited Watersheds," Geo. L. Wells; "Backwater and Flowage," Robert E. Horton; "Dowagiac River Improvement," W. H. Goss; "A Recent Arizona Excursion," A. W. Barber;

"Timber Cruising," D. A. Brotherton; "Drainage, Ventilation and Heating," A. B. Raymond; "Use of True Meridian in a Resurvey," E. Strong; "The Cost of Macadam Road Building," P. F. Rogers; "Water Cost and Water Waste," A. L. Holmes; "The St. Clair Flat Survey," Prof. J. B. Davis. There are also the Government Instructions to Surveyors, and a digest of recent legal decisions relating to surveys. Mr. Holmes' paper on water waste was abstracted in Engineering News of Feb. 6, 1902, and Mr. Rogers' paper on macadam costs in the same journal for March 6, 1902.

IOWA ENGINEERING SOCIETY.—Annual meeting at Cedar Rapids, Ia., Jan. 15 to 17, 1902. W. H. Jackson, Secretary, Des Moines, Ia. Paper; 6 × 9 ins.; pp. 151; illustrated. 50 cts.

The lengthy report of the committee on paving brick, included herein, has been reprinted as a separate pamphlet, and is noticed elsewhere in this Supplement. A feature of this report is a number of brief but practical papers on work actually carried out, as follows: "A Tunnel for Underground Pipes," at the Iowa State College, Ames, Ia., by Prof. G. W. Bissell; "Laying Submerged Water Pipe," by Chas J. Fox, Cedar Rapids, Ia.; "Construction of Concrete Sea-Walls Along Des Moines River, in Des Moines, Ia.," by J. B. Marsh, of Des Moines, and "Track-Laying Machinery," by G. D. Weeks, Iowa City. There are also papers and discussions on land surveying, sewerage and concrete.

ROAD CONVENTIONS IN THE SOUTHERN STATES. Bulletin No. 23, Public Road Inquiries. Washington, D. C.: U. S. Department of Agriculture. Paper; 6 × 9 ins.; pp. 89; illustrated.

This bulletin describes the road work done in the South under the supervision of the office of Public Road Inquiries, with the co-operation of the Southern Railway, during the winter of 1901 and spring of 1902. A "good roads train," consisting of 10 or 12 carloads of road-making machinery, traveled from place to place, building object-lesson roads, the total length built being about 15 miles in five months. The bulletin is largely given up to chronicling the speeches of officials at the various stops made. In one of the best of these speeches the speaker said:

> A good road is a generator and a radiator of benefit to all who live upon it or move upon it. A man likes to locate in a land of good roads. They are the lightning rods to attract intelligent settlers. A good road is a faithful friend and a cheerful companion. It is the best of investments and the best of advertisements. It is a poster that nobody wants to deface, and that you can't pull down. . . . The public road is the best place in the world for convicts to labor, and it is in accord with poetic justice. We are trying to help them mend their ways. Then, why shouldn't they help us to mend our ways.

A large number of "before and after" photogravures illustrate the work done by the good roads train.

It is to be regretted that the text accompanying these photographs gives very little as to the exact methods of construction, quantities of materials, and labor cost, involved in performing each piece of work. Macadam roads cannot be built for the $800 to $1,000 a mile claimed by one of the speech-makers, except possibly with convict labor, and as this question of cost is one of greatest interest to the taxpayers of each district we should think that it might have been answered in this bulletin had a record of costs been kept. It will do the good roads movement more harm than good to belittle the cost of road improvement.

NINTH ANNUAL REPORT OF THE COMMISSIONER OF PUBLIC ROADS OF THE STATE OF NEW JERSEY.—By Henry I. Budd, Commissioner. Trenton, N. J. Paper; 6 × 9 ins.; pp. 243; illustrated, including a road map of New Jersey.

This very interesting report shows that under ten years of the State aid law, New Jersey has built 800 miles of macadam and gravel roads. In addition, 45 miles are under construction and petitions have been filed for 550 miles more. Of 53 roads built in 1902 it is instructive to note that 11 were of gravel, averaging 8 ins. thick; 17 of broken stone, 8 ins. thick by 12 to 16 ft. wide; 15 of broken stone, 6 ins. thick by 14 ft. average width; 4 of broken stone, 4 ins. thick by 16 ft. wide; and the remaining 6 of broken stone of varying thickness and width. The thickness in each case is measured after rolling in place, and it is stated that a 5-in. layer of loose trap rock compacts to 4 ins. under the roller, after which screenings must be added to fill the voids.

The report gives the itemized contract cost of each road, and in that respect is far more instructive than the similar Report of the New York State Engineer. It is true that in New York State a lump sum is bid for each road, but if the earth and macadam yardage and other items were given by the State Engineer for each road, intelligent comparison of costs would be possible. It is noteworthy that, mile for mile, roadwork in New York State is costing about double what it is in New Jersey.

NEW YORK DEPARTMENT OF LABOR.—Including the First General Report of the Commissioner of Labor, the Sixteenth Annual Report on Factory Inspection, the Nineteenth Annual Report of the Bureau of Labor Statistics, and the Fifteenth Annual Report on Mediation and Arbitration, for varying periods ending Sept. 30, 1901. John McMackin, Commissioner, Albany, N. Y. Pub. Doc. Cloth; 6 × 9 ins.; pp. (three volumes) 615, 640 + 128 and 424; many tables.

The various branches of the government of New York State mentioned in the sub-title were consolidated in 1901 into a Department of Labor, and the fiscal years of the three old departments, previously all different, were made co-terminous. The three volumes before us contain a mass of statistical and other information regarding labor and the labor interests, including reprints of the New York statutes relating to labor and allied topics, and some court decisions overturning some and upholding others of these statutes. A review of "The Economic Condition of Organized Labor," in the volume devoted to the Bureau of Labor Statistics, may perhaps be considered as a summary and discussion of the detailed statistics in that volume. It gives some interesting figures regarding the recent growth and present conditions of labor unions in New York, and similar information on changes in wages and hours of employment, periods unemployed, and the like.

THE WOODSMAN'S HAND-BOOK.—Part I., Revised Edition. By Henry Solon Groves, Director of the Yale Forest School. Washington, D. C. Department of Agriculture. Flexible cloth; 4 × 6 ins.; pp. 144, many tables, one folding map, and 15 figures.

This handy little book includes a collection of tables and rules for the use of "lumbermen, foresters and others interested in the measurement of wood and timber." It includes "only such information as is deemed of immediate practical value to American woodsmen." There are brief descriptions of the origin and use of 45 different log rules for board measure, prefaced by tables showing the contents of logs of different lengths and diameters as obtained by the various rules. There are sections on cord, cubic and board measure; volume tables of standing trees of different diameters and species. Another section is devoted to methods of estimating standing timber, and there are two pages on forest working plans. The last 18 pages describe the engineering and other measuring instruments useful to a woodsman, many of which are illustrated. As the book contains copyrighted matter from various sources it is not, like most other government publications, placed on sale, but can be obtained only from Members of Congress and from the Department of Agriculture.

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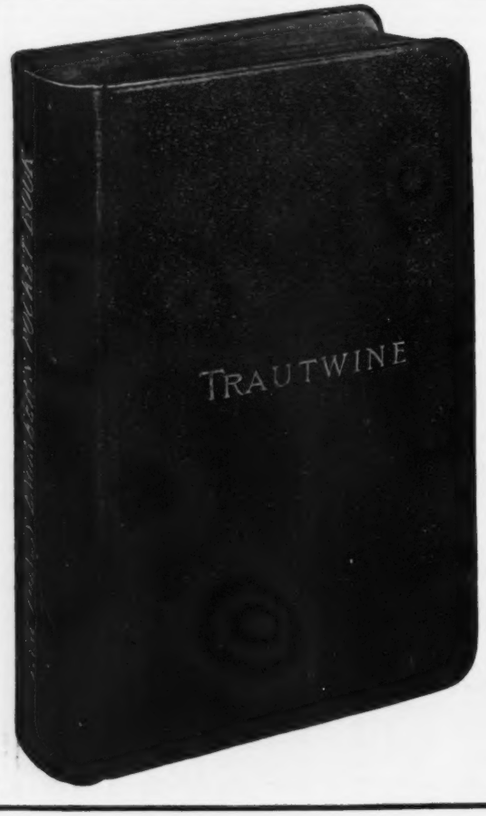

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STATE ENGINEER OF COLORADO.—Report for the year 1901 and 1902. Addison J. McCune, State Engineer. Denver: Pub. Doc. Cloth; 6 × 9 ins.; pp. 334; tables and illustrations.

The work of the State Engineer of Colorado is mostly connected with irrigation, but recently road improvements and bridge buildings, paid for from the State internal improvement fund, have been put in charge of the department. The bulk of the present volume is made up of reports from the various superintendents of irrigation and water commissioners, of crop statistics, and other routine matters. A special report on "Drainage and Seepage Measurements," by C. G. Elliott, Agent and Expert, U. S. Irrigation Investigations, is included, and also some fifty pages on "The Measurement of Water," by Mr. A. L. Fellows, Resident Hydrographer, U. S. Geological Survey. The latter is a reprint of a large portion of a bulletin on the subject named.

NEW DIRECTIONS IN THE ART OF WATER PURIFICATION.—By Nicholas P. Simin, Chief Engineer of the Water-Works of Moscow, Russia. A Paper read before the Russian Pirogoff Medical Association, at Moscow, 1902. Paper; 6 × 10 ins.; pp. 31. Address the author.

OZONIZATION OF WATER.—By N. P. Simin. Read before the Fifth Convention of the Russian Water-Works Association. Paper; 6 × 10 ins.; pp. 68; tables.

AMERICAN METHODS OF WATER PURIFICATION.—By N. P. Simin. Paper; 6 × 10 ins.; pp. 106; tables and illustrations.

ELECTROLYSIS.—By N. P. Simin. A Paper read before the Eighth Convention of the Russian Water-Works Association. Paper; 6 × 10 ins.; pp. 24; illustrated.

DOMESTIC-FIRE PROTECTION WATER-WORKS AT TOBOLSK, SIBERIA.—On the System of N. P. Simin. Paper; 6 × 10 ins.; pp. 39; folding map.

THE DESIRABILITY, THE POSSIBILITY, AND THE USEFULNESS OF BUILDING CITY WATER-WORKS ADAPTED TO A DIRECT FIGHTING OF FIRES.—By N. P. Simin. A Paper read before the Russian Fire Convention, Moscow, 1902. Paper; 6 × 10 ins.; pp. 9.

FIRE PROTECTION WATER-WORKS.—By N. P. Simin. Paper; 6 × 10 ins.; pp. 16.

RESULTS OF THE USE OF SOMARA DOMESTIC-FIRE PROTECTION WATER-WORKS, 1887 TO 1902.—By N. B. Chumakoff, C. E. A paper read before the Russian Fire Convention, Moscow, 1902. Paper; 6 × 10 ins.; pp. 18; tables.

As these papers are printed in Russian, and therefore unavailable to all but a small percentage of our readers, no apology is needed for not analyzing their contents. Translation of the titles, we take pleasure in acknowledging, were very kindly sent with the pamphlets by Mr. Simin and his daughter, whose visit to this country a few years since, to study American water-works practice, is remembered with pleasure by some of our readers.

CENTRAL STATES WATER-WORKS ASSOCIATION.—Proceedings of the Annual Convention of 1902. Wm. Allen Veach, Secretary, Newark, O. Paper; 6 × 8 ins.; pp. 81; illustrated. $1.

The principal papers in this report are as follows: "Street Sprinkling Wagons," C. W. Wiles; "Flushing the Mains," John Langan; "Automatic Sprinklers and their Water Rates," C. E. Inman; "Testing Wells Connected to a Suction Main," James R. Maxwell; "Eighteen Years' Experience in the Purification of Water at Lexington, Ky.," S. A. Charles; "Fire Streams," F. A. W. Davis; "Stream Pollution, and its Pecuniary Damage to Natural Water Courses," M. O. Leighton; "Submerged Pipe," A. L. Holmes; "Electrolysis," L. Clifford Anderson. Abstracts of a number of these papers, and of the accompanying discussions, appeared in Engineering News of Oct. 2, 1902. The paper by Mr. Holmes was given at considerable length.

PROCEEDINGS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.—Published by the Association Secretary, S. F. Patterson, B. & M. R. R., Concord, N. H. Paper; 6 × 9 ins.; pp. 260; illustrated.

This volume contains the report of the proceedings of the twelfth annual convention, held at Minneapolis in October, 1902. The subjects of the principal committee reports are as follows: (1) Auxiliary Coaling Stations; (2) Roof Coverings; (3) Mail Cranes; (4) Railway Track Pile Drivers; (5) Roundhouse Pits; (6) Materials for Paving Highway Bridges. Some of these reports are quite lengthy, giving details of practice on various roads and being accompanied by numerous illustrations. The reports on coaling stations and railway pile drivers are specially noted in this connection. In addition to the discussions of the above reports there are discussions of the subjects presented at the meeting of 1901.

REPORT OF THE TESTS OF METALS and Other Materials for Industrial Purposes, Made with the United States Testing Machines at Watertown Arsenal, Massachusetts, during the Year Ended June 30, 1901. Washington, D. C.: War Department. Cloth; 6 × 9¼ ins.; pp. 659; illustrated.

As usual, this annual conglomeration of records of individual tests is put together without any summary, comparison, or digest of results. Of course, it contains much useful information, but presented in such shape that it is of little practical value. Among the records of individual tests of metal for gun forgings, rifle barrels and other military equipment, tests of internal strains in gun forgings, and tests of springs, bars, bricks, cement, concrete, glass, etc., we find two subjects of rather exceptional character. The first consists of tests of solid eye-bars and eye-bars made with riveted and bolted splices in the body of the bar. Records of a number of tests on each type of bar are given, but there is no comparison of results to show what advantages or disadvantages were presented by the different methods of construction. The other subject is the test of yellow pine push-bars embedded in concrete, the bars being intended to receive the thrust of jacks for tunneling shields at Boston. The records of tests of cement and concrete cover about 150 pages and are accompanied by 46 folding plates of diagrams. So far as practical utility is concerned this annual volume may well be classed with certain other government publications which were criticized editorially in Engineering News of Feb. 12.

REPORT OF THE "HOHENSTEIN BOILER" AND "LIQUID FUEL" BOARDS.—Made by Direction of Rear-Admiral George W. Melville, U. S. N. Washington, D. C.: Navy Department. Paper; 5½ × 9 ins.; pp. 107; illustrated.

This report contains an enormous amount of data showing the relative evaporating efficiencies of liquid fuel and coal under forced and natural draft conditions, as determined by an extended series of tests. Burners using steam for atomizing and burners using air were tested, and many other questionable points of like nature were investigated. To any one interested in fuel oil this report will be of great value.

The following are some of the conclusions reached by the Board:

(a) That oil can be burned in a very uniform manner.

(b) That the evaporative efficiency of nearly every kind of oil per pound of combustible is probably the same.

(c) That a marine steam generator can be forced to even as high a degree with oil as with coal.

(d) That up to the present time no ill effects have been shown upon the boiler.

(e) That the firemen are disposed to favor oil.

(f) That air for combustion should be pre-heated if possible. Such action undoubtedly assists the gasification of the oil.

(g) That the oil should be heated that it may be atomized more readily.

(h) That when using steam atomizers higher steam pressures are undoubtedly more advantageous for atomizing the oil.

(i) That under heavy forced draft and particularly when steam for atomizing is used, the board has not yet found it possible to prevent smoke from issuing from the stack.

(j) That the consumption of liquid fuel can not probably be forced to as great an extent with steam as the atomizing agent as with compressed air. This is probably due to the fact that the compressed air supplies oxygen for combustion, while steam displaces air.

(k) The form of the burner will play very small part, and where simple and scientific in design there will be little difference in their efficiency.

INCOME ACCOUNT OF RAILWAYS OF THE UNITED STATES.—Washington, D. C.: Interstate Commerce Commission. Paper; 6 × 9 ins.; pp. 72.

This is a preliminary report for the year ending June 30, 1902, prepared by Mr. Henry C. Adams, the Statistician to the Commission. The report itself occupies only a few pages, and includes summaries of earnings and operating expenses. The remainder of the pamphlet consists of a tabulated statement of returns of gross earnings, net earnings and dividends from 680 individual railways.

TURNING AND BORING TAPERS.—By Fred. H. Colvin. Being No. 1 of a Series of Practical Papers. New York: The Derry-Collard Co. Paper; 5 × 8 ins.; pp. 24; illustrated. 25 cts.

This is an exceedingly clear monograph, and has evidently been written especially for the

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EXPERIMENTS
ON THE
Flexure of Beams;
Discovery of New Laws

By ALBERT E. GUY
Reprinted from the "AMERICAN MACHINIST."

The analogy of the failure of the compression side of a beam by buckling, to the method of failure of a long column was, of course, long ago remarked, but we believe there has been no previous attempt—certainly no successful attempt—to connect the two by a formula. Mr. Guy's experiments have been successful beyond any reasonable expectation in connecting them, and in showing that Euler's formula for long columns is, in fact, the fundamental formula which lies at the base of the whole subject.

We believe there is not in any existing text-book, a formula by which the strength of a long beam unsupported sideways, may be determined. Mr. Guy discloses the laws of failure in this manner, for the first time, and they are, in consequence, entitled to be called, as we shall hereafter call them, Guy's laws. The disclosure of such laws alone would be a notable achievement, but when to this is added the connection through definite formulas of long beams and columns, including inclined beams acted upon by vertical forces, the accomplishment is nothing less than brilliant.—Extracts from Preface.

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young machinist so as to teach him the "tricks of the trade" in so far as taper turning, boring and threading are concerned.

Literary Magazines.

The best location for astronomical observatories is the subject of a paper in the March "Century," by Prof. Wm. H. Pickering, who has had charge of much of the work of Harvard University in connection with astronomical observations in the tropics. It was formerly supposed that the ideal location for an observatory was on a high mountain, where the air would be less dense than near sea level. In accordance with this theory an observatory was located at Arequipa, Peru, at an elevation of 8,060 ft. above sea level, and some excellent work was done there. It is now found, however, that the chief requirement for good observing is a steady atmosphere, and that neither altitude nor humidity have much to do with this. It is influenced, however, by the latitude and it is probable that could a location be found which was sufficiently cloudless, an observatory on the equator would have an ideal location.

The "Century" also has several articles on current business and economic matters, the most important of which is an account of the development of the Tobacco Trust, an organization which has a capitalization of $400,000,000 and which controls the tobacco trade in every country of the world save those in which it is carried on as a Government monopoly. And the trust is only 13 years old!

"The question of Franchises" is the title of a valuable paper in the "Atlantic" by Mr. Geo. C. Sikes, and so much wisdom is compressed in a nutshell in the opening sentence that we quote it here:

> American cities are rapidly beginning to realize that the question of franchises is the most important phase of the city government problem, and that the public service corporations under present conditions are the most active and potent cause of continuing municipal corruption and misgovernment.

The author is secretary of the Municipal Voters' League of Chicago, and we heartily commend his paper to our readers. A remarkable illustration of the trend of public opinion toward municipal ownership of public utilities is the vote taken in Chicago a year ago, the result of which was as follows:

	For.	Against.
Municipal ownership of street railways...	142,826	27,998
Municipal ownership of lighting plants....	139,999	21,364

In the March "Review of Reviews" we find two interesting popular articles on the lumber industry of the Pacific Coast and the German Merchant Marine; also a description by Mr. T. C. Martin, of the Shawinigan Falls electric power transmission plant in Canada, where 30,000 HP. is to be transmitted a distance of 84 miles at a pressure of 50,000 volts.

"The New Nile Reservoir"—that created by the great Assuan dam, is described by Mr. Frederic C. Penfield in the March "North American Review." Our readers are already familiar with this work and its objects; and we note here only the interesting comparison with which Mr. Penfield opens his paper. He contrasts the great feat wrought by English armies in South Africa with that wrought by English engineers in North Africa and he says: "To my mind, the triumph of the studious engineer is thousands of times greater than that of Field-Marshal and General."

In the same magazine Admiral Melville writes on "Our Actual Naval Strength" and we commend his paper to the thoughtful study of those ardant patriots who a month or two ago were agitating for an immediate increase of our naval forces, as absolutely essential to our National safety. Admiral Melville shows that naval strength is not a mere matter of guns and armor and that when all factors are taken into account, the United States is impregnable.

Turning to the English reviews now at hand, those for February—we find the present position of wireless telegraphy reviewed in the "Nineteenth Century" by Charles Bright. He warns the public against the exaggerations of those who predict that the new system will drive out of use existing systems of communication, but declares his belief that the new ether telegraphy is destined to become of vast commercial importance. In both the "Fortnightly" and the "Contemporary" we find papers discussing the food supply of England in war time. It has come to be clearly recognized that the fact that her food supply comes from outside her own borders and that the supply on hand at any time is sufficient for only a few weeks is England's most vulnerable point. England's vast navy is maintained to protect this food supply. It is not a mere matter of victory or defeat in war, but of national existence which is at stake. It is when we compare such a position with that of this country that the needlessness of our attempting to vie with Great Britain in ships of war becomes apparent.

U. S. GEOLOGICAL SURVEY.—Report for 1900-1. By Charles D. Walcott, Director. Washington, D. C. Cloth; 7¾ x 11¼ ins.; many illustrations. Part I., Director's Report and a Paper on Asphalt and Bituminous Rock Deposits; pp. 464; Part II., Ore Deposits; pp. 888; Part III., Coal, Oil and Cement, pp. 761.

The first half of Part I. of this report contains the directors' financial statements, giving the cost per square mile of contour mapping (20-ft. contours), and the areas thus far mapped in the United States. Since the contour sheets can be bought for 5 cts. each, or $2 per hundred sheets, every civil or mining engineer engaged in general practice would do well to send for this Part I., that he may know just what districts have been mapped.

The last half of Part II. is devoted to "Asphalt and Bituminous Rocks of the United States," by George H. Eldridge. A brief description of the location, mode of formation and chemical constituents of the natural asphalts and bitumens is given, without any discussion of their relative merits for paving or other purposes.

Under "Ore Deposits," Part II., we find several monographs, as follows: "The Old Tungsten Mine at Trumbull, Conn." (pp. 9), by W. H. Hobbs; "Preliminary Report on the Lead and Zinc Deposits of the Ozark Region" (Mo. and Ark.) (pp. 206), by H. F. Bain, C. R. Van Hise, and G. I. Adams; "The Ore Deposits of the Rico Mountains, Colorado" (pp. 170), by F. L. Ransome; "Geology and Ore Deposits of the Elkhorn Mining District, Jefferson County, Montana" (pp. 152), by W. H. Weed and J. Barrell; "The Gold Belt of the Blue Mountains of Oregon" (pp. 226), by W. Lindgren; and "The Ore Deposits of Monte Cristo, Washington" (pp. 90), by J. E. Spurr.

The last named was editorially commented upon in Engineering News of Jan. 1, 1903; and some of the other monographs will be discussed in later issues. We may say here that they abound in unneccessary repetition, and show an utter disregard of the value of printers' ink and paper as compared with the information conveyed. There are many valuable facts contained in this volume, but it is hard to find them.

Part III. treats of "Coal, Oil and Cement," and the contained papers or monographs are as follows: "The Coal Fields of the United States" (pp. 18), "The Atlantic Coast Triassic Coal Field" (pp. 30), "The Pennsylvania Anthracite Coal Field" (pp. 64), "The Bituminous Coal Fields of Pennsylvania, Maryland and Ohio" (pp. 108); then follow a number of separate papers on the coal fields of the Southern Appalachian, the Eastern, the Northern, the Western, and the Southwestern Interiors, the Rocky Mountains, and the Pacific Coast, filling in all 246 pages. Following these come: "The Coal Resources of Alaska" (pp. 58), "The Gaines Oil Field of Northern Pennsylvania" (pp. 56), "The Portland Cement Industry in Michigan" (pp. 58), and "The Chalk of Southwestern Arkansas, as Adapted to Cement Making" (pp. 54).

We are pleased to note that Part III., on coal, is not open to many of the criticisms that may be urged against Part II. on Ore Deposits. While Part III. is by no means free from reprehensible prolixity, it cannot be said that facts are wholly buried under a mass of words. We do not believe that it is necessary to describe and picture methods of mining anthracite, for example, since such descriptions are to be found in text books on mining. However, no great space is thus taken up, and the general reader (if there are such who need to be considered) will find the information interesting.

This Part III., on the whole, more nearly approaches our conception of what such a report should be, although it could have been condensed to one-half, or even one-third its present size, without losing anything of real value.

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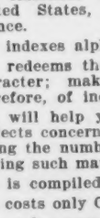

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